HARRIS

2N6767
2N6768

N-Channel Enhancement-Mode Power MOS Field-Effect Transistors

August 1991

Features

- **12A and 14A, 350V - 400V**
- **$r_{DS(on)}$ = 0.4Ω and 0.3Ω**
- **SOA is Power-Dissipation Limited**
- **Nanosecond Switching Speeds**
- **Linear Transfer Characteristics**
- **High Input Impedance**
- **Majority Carrier Device**

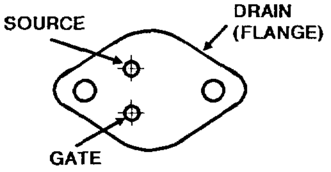
Description

The 2N6767 and 2N6768 are n-channel enhancement-mode silicon-gate power MOS 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.

These types are supplied in the JEDEC TO-204AA steel package.

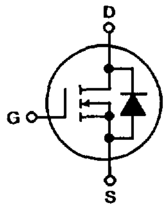
Package

TO-204AA
BOTTOM VIEW



Terminal Diagram

N-CHANNEL ENHANCEMENT MODE



Absolute Maximum Ratings (T_C = +25°C) Unless Otherwise Specified

		2N6767	2N6768	UNITS
Drain-Source Voltage	V_{DS}	350*	400*	V
Drain-Gate Voltage (R_{GS} = 20kΩ)	V_{DGR}	350*	400*	V
Continuous Drain Current				
T_C = +25°C	I_D	12*	14*	A
T_C = +100°C	I_D	7.75*	9*	A
Pulsed Drain Current	I_{DM}	20	25	A
Gate-Source Voltage	V_{GS}	±20*	±20*	V
Maximum Power Dissipation				
T_C = +25°C (See Figure 11)	P_D	150*	150*	W
Above T_C = +25°C, Derate Linearly		1.2*	1.2*	W/°C
Inductive Current, Clamped (See Figures 1 and 2, L = 100µH)	I_{LM}	20	25	A
Operating and Storage Junction Temperature Range	T_J, T_{STG}	-55 to +150*	-55 to +150*	°C
Maximum Lead Temperature for Soldering (0.063" (1.6mm) from case for 10s)	T_L	300*	300*	°C

*JEDEC registered values

CAUTION: These devices are sensitive to electrostatic discharge. Proper I.C. handling procedures should be followed.

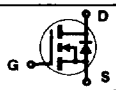
Electrical Characteristics @ $T_C = 25^oC$ (Unless Otherwise Specified)

Parameter	Type	Min.	Typ.	Max.	Units	Test Conditions
BV_{DSS} Drain – Source Breakdown Voltage	2N6767	350	–	–	V	$V_{GS} = 0$
	2N6768	400	–	–	V	$I_D = 1.0$ mA
$V_{GS(th)}$ Gate Threshold Voltage	ALL	2.0*	–	4.0*	V	$V_{DS} = V_{GS}$, $I_D = 1$ mA
I_{GSSF} Gate – Body Leakage Forward	ALL	–	–	100*	nA	$V_{GS} = 20V$
I_{GSSR} Gate – Body Leakage Reverse	ALL	–	–	100*	nA	$V_{GS} = -20V$
I_{DSS} Zero Gate Voltage Drain Current	ALL	–	0.1	1.0*	mA	V_{DS} = Max. Rating, $V_{GS} = 0$
		–	0.2	4.0*	mA	V_{DS} = Max. Rating, $V_{GS} = 0$, $T_C = 125^oC$
$V_{DS(on)}$ Static Drain-Source On-State Voltage ①	2N6767	–	–	5.4*	V	$V_{GS} = 10V$, $I_D = 12A$
	2N6768	–	–	5.6*	V	$V_{GS} = 10V$, $I_D = 14A$
$R_{DS(on)}$ Static Drain-Source On-State Resistance ①	2N6767	–	0.3	0.4*	Ω	$V_{GS} = 10V$, $I_D = 7.75A$
	2N6768	–	0.25	0.3*	Ω	$V_{GS} = 10V$, $I_D = 9.0A$
$R_{DS(on)}$ Static Drain-Source On-State Resistance ①	2N6767	–	–	0.88*	Ω	$V_{GS} = 10V$, $I_D = 7.75A$, $T_C = 125^oC$
	2N6768	–	–	0.66*	Ω	$V_{GS} = 10V$, $I_D = 9.0A$, $T_C = 125^oC$
g_{fs} Forward Transconductance ①	ALL	8.0*	11.0	24*	S (℧)	$V_{DS} = 15V$, $I_D = 9.0A$
C_{iss} Input Capacitance	ALL	1000*	2000	3000*	pF	$V_{GS} = 0$, $V_{DS} = 25V$, f = 1.0 MHz See Fig. 10
C_{oss} Output Capacitance	ALL	200*	400	600*	pF	
C_{rss} Reverse Transfer Capacitance	ALL	50*	100	200*	pF	
$t_{d\ (on)}$ Turn-On Delay Time	ALL	–	–	35*	ns	$V_{DD} \cong 180V$, $I_D = 9.0A$, $Z_o = 4.7\Omega$ (See Figs. 13 and 14) (MOSFET switching times are essentially independent of operating temperature.)
t_r Rise Time	ALL	–	–	65*	ns	
$t_{d\ (off)}$ Turn-Off Delay Time	ALL	–	–	150*	ns	
t_f Fall Time	ALL	–	–	75*	ns	

Thermal Resistance

R_{thJC} Junction-to-Case	ALL	–	–	0.83*	°C/W	
R_{thCS} Case-to-Sink	ALL	–	0.1	–	°C/W	Mounting surface flat, smooth, and greased.
R_{thJA} Junction-to-Ambient	ALL	–	–	30	°C/W	Free Air Operation

Body-Drain Diode Ratings and Characteristics

I_S Continuous Source Current (Body Diode)	2N6767	–	–	12*	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier. 
	2N6768	–	–	14*		
I_{SM} Pulsed Source Current (Body Diode)	2N6767	–	–	20	A	
	2N6768	–	–	25		
V_{SD} Diode Forward Voltage ①	2N6767	0.8*	–	1.6*	V	$T_C = 25^oC$, $I_S = 12A$, $V_{GS} = 0$
	2N6768	0.85*	–	1.7*	V	$T_C = 25^oC$, $I_S = 14A$, $V_{GS} = 0$
t_{rr} Reverse Recovery Time	ALL	–	1000	–	ns	$T_J = 150^oC$, $I_F = I_{SM}$, $dI_F/dt = 100$ A/μs
Q_{RR} Reverse Recovered Charge	ALL	–	25	–	μC	$T_J = 150^oC$, $I_F = I_{SM}$, $dI_F/dt = 100$ A/μs

*JEDEC registered values. ① Pulse Test: Pulse Width ≤ 300 μsec, Duty Cycle ≤ 2%

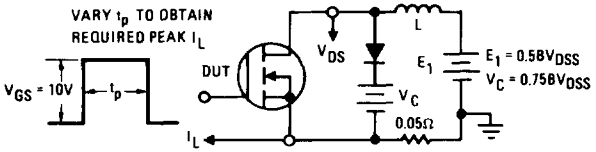


Fig. 1 - Clamped inductive test circuit.

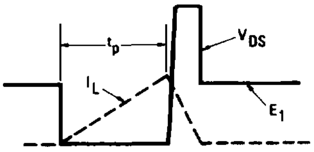


Fig. 2 - Clamped inductive waveforms.

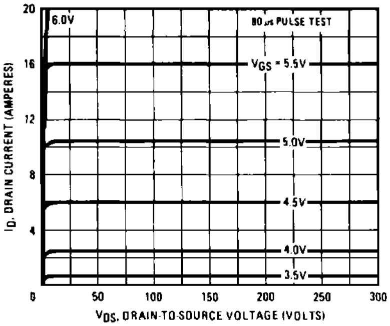


Fig. 3 - Typical output characteristics for both types.

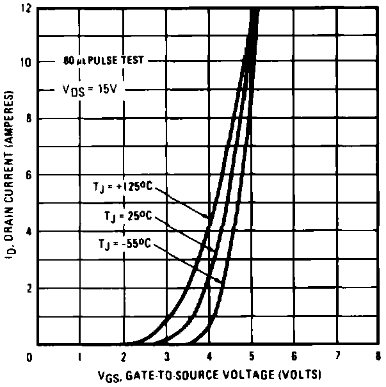


Fig. 4 - Typical transfer characteristics for both types.

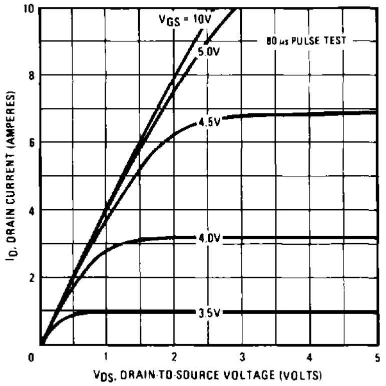


Fig. 5 - Typical saturation characteristics for the 2N6767.

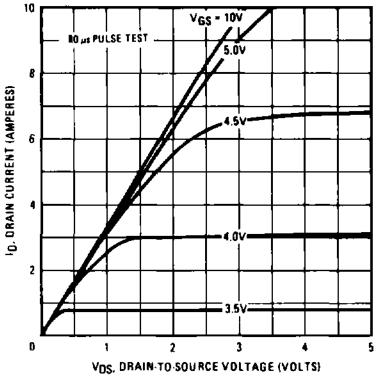


Fig. 6. - Typical saturation characteristics for the 2N6768.

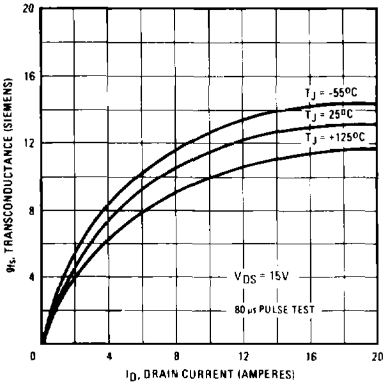


Fig. 7 - Typical transconductance versus drain current for both types.

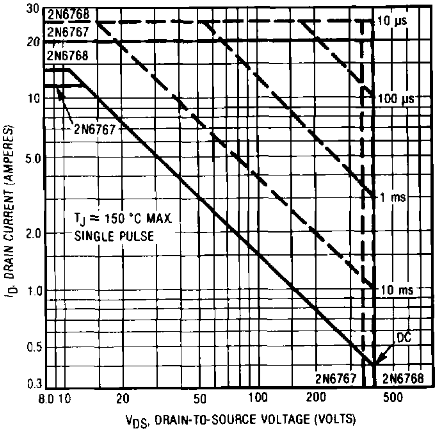


Fig. 8 - Maximum safe operating area for both types.

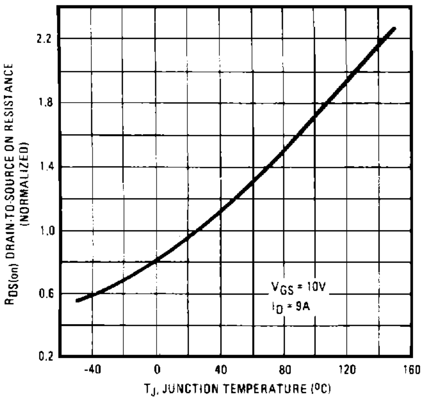


Fig. 9 - Typical normalized on-resistance versus temperature for both types.

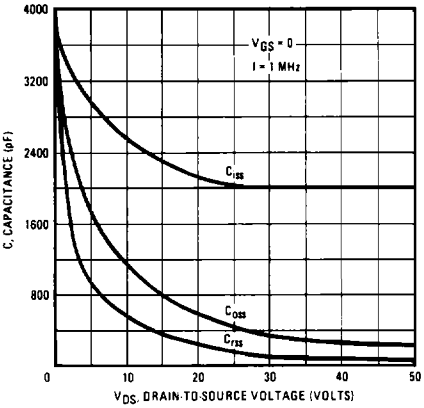


Fig. 10 - Typical capacitance versus drain-to-source voltage for both types.

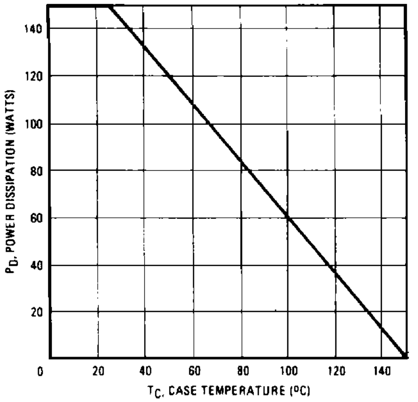


Fig. 11 - Power versus temperature derating curve for both types.

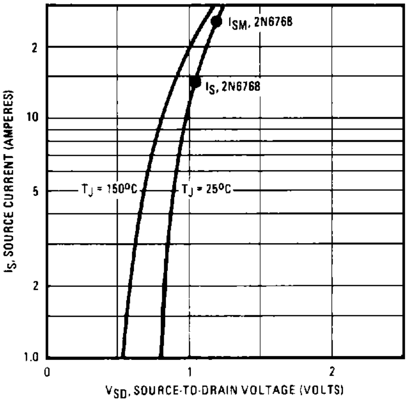


Fig. 12 - Typical body-drain diode forward voltage for both types.

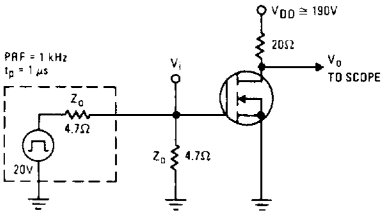


Fig. 13 - Switching time test circuit.

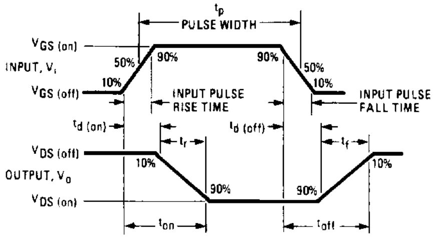


Fig. 14 - Switching time waveforms