

August 1991

Features

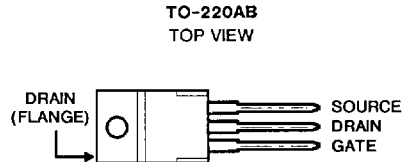
- 3.8A and 3.3A, 250V - 275V
- $r_{DS(on)} = 1.1\Omega$ and 1.5Ω
- Single Pulse Avalanche Energy Rated
- SOA is Power-Dissipation Limited
- Nanosecond Switching Speeds
- Linear Transfer Characteristics
- High Input Impedance
- 250/275V DC Rating - 120V AC Line System Operation

Description

The IRF624, IRF625, IRF626, and IRF627 are advanced power MOSFETs designed, tested and guaranteed to withstand a specified level of energy in the breakdown avalanche mode of operation. These 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.

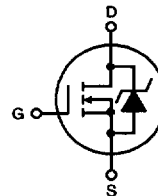
The IRF-types are supplied in the JEDEC TO-220AB plastic package.

Package



Terminal Diagram

N-CHANNEL ENHANCEMENT MODE



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

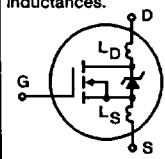
	IRF624	IRF625	IRF626	IRF627	UNITS
Drain-Source Voltage (1)	V_{DS} 250	250	275	275	V
Drain-Gate Voltage ($R_{GS} = 20k\Omega$) (1)	V_{DGR} 250	250	275	275	V
Continuous Drain Current					
$T_C = +25^\circ\text{C}$	I_D 3.8	3.3	3.8	3.3	A
$T_C = +100^\circ\text{C}$	I_D 2.4	2.1	2.4	2.1	A
Pulsed Drain Current (3)	I_{DM} 15	13	15	13	A
Gate-Source Voltage	V_{GS} ± 20	± 20	± 20	± 20	V
Maximum Power Dissipation					
$T_C = +25^\circ\text{C}$	P_D 40	40	40	40	W
Linear Derating Factor	0.32	0.32	0.32	0.32	W/ $^\circ\text{C}$
Single Pulse Avalanche Energy Rating (4)	E_{AS} 120	120	120	120	mJ
Operating and Storage Junction	T_J, T_{STG} -55 to +150	-55 to +150	-55 to +150	-55 to +150	$^\circ\text{C}$
Temperature Range					
Maximum Lead Temperature for Soldering	T_L 300	300	300	300	$^\circ\text{C}$
(0.063" (1.6mm) from case for 10s)					

NOTES:

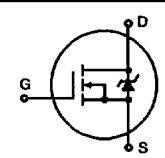
- $T_J = +25^\circ\text{C}$ to $+150^\circ\text{C}$
- Pulse Test: Pulse width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2\%$.
- Repetitive rating: Pulse width limited by maximum junction temperature. See Transient Thermal Impedance Curve (Figure 5).
- $V_{DD} = 50\text{V}$, starting $T_J = +25^\circ\text{C}$, $L = 13.6\text{mH}$, $R_{GS} = 25\Omega$, $I_{PEAK} = 3.8\text{A}$. See Figures 14 & 15.

Specifications IRF624, IRF625, IRF626, IRF627

Electrical Characteristics $T_C = 25^\circ\text{C}$, Unless Otherwise Specified

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	LIMITS			UNITS
			MIN	TYP	MAX	
Drain-Source Breakdown Voltage IRF624, IRF626 IRF625, IRF627	BV _{DSS}	V _{GS} = 0V, I _D = 250μA	275	-	-	V
			250	-	-	V
Gate Threshold Voltage	V _{GS(TH)}	V _{DS} = V _{GS} , I _D = 250μA	2.0	-	4.0	V
Gate-Source Leakage Forward	I _{GSS}	V _{GS} = 20V	-	-	500	nA
Gate-Source Leakage Reverse	I _{GSS}	V _{GS} = -20V	-	-	-500	nA
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = Max Rating, V _{GS} = 0V	-	-	250	μA
		V _{DS} = Max Rating x 0.8, V _{GS} = 0V, T _J = +125°C	-	-	1000	μA
On-State Drain Current (Note 2) IRF624, IRF626 IRF625, IRF627	I _{D(ON)}	V _{DS} > I _{D(ON)} x r _{DS(ON)} Max, V _{GS} = 10V	3.8	-	-	A
			3.3	-	-	A
Static Drain-Source On-State Resistance (Note 2) IRF624, IRF626 IRF625, IRF627	r _{DS(ON)}	V _{GS} = 10V, I _D = 1.4A	-	0.8	1.1	Ω
			-	1.05	1.5	Ω
			-	-	-	-
Forward Transconductance (Note 2)	g _{fs}	V _{DS} = 2 x V _{GS} , I _{DS} = 1.9A	1.4	2.1	-	S(Ω)
Input Capacitance	C _{iSS}	V _{GS} = 0V, V _{DS} = 25V, f = 1.0MHz	-	340	-	pF
Output Capacitance	C _{oSS}	See Figure 10	-	110	-	pF
Reverse Transfer Capacitance	C _{rSS}		-	32	-	pF
Turn-On Delay Time	t _{d(ON)}	V _{DD} = 125V, I _D = 3.8A, R _G = 18Ω	-	11	17	ns
Rise Time	t _r	See Figure 16. (MOSFET switching times are essentially independent of operating temperature)	-	24	36	ns
Turn-Off Delay Time	t _{d(OFF)}		-	21	32	ns
Fall Time	t _f		-	13	20	ns
Total Gate Charge (Gate-Source + Gate-Drain)	Q _g	V _{GS} = 10V, I _D = 3.8A, V _{DS} = 0.8 Max Rating. See Figure 17 for test circuit.	-	15	22	nC
Gate-Source Charge	Q _{gs}	(Gate charge is essentially independent of operating temperature.)	-	4.0	-	nC
Gate-Drain ("Miller") Charge	Q _{gd}		-	7.2	-	nC
Internal Drain Inductance	L _D	Measured between the contact screw on header that is closer to source and gate pins and center of center of die.	-	4.5	-	nH
Internal Source Inductance	L _S	Measured from the source lead, 6mm (0.25") from header and source bonding pad.	-	7.5	-	nH
		Modified MOSFET symbol showing the internal device inductances.				
Junction-to-Case	R _{θJC}		-	-	3.12	°C/W
Case-to-Sink	R _{θCS}	Mounting surface flat, smooth and greased	-	0.5	-	°C/W
Junction-to-Ambient	R _{θJA}	Free air operation	-	-	80	°C/W

Source Drain Diode Ratings and Characteristics

Continuous Source Current (Body Diode)	I _S	Modified MOSFET symbol showing the integral reverse P-N junc. rectifier.		-	-	3.8	A
Pulse Source Current (Body Diode) (Note 3)	I _{SM}			-	-	15	A
Diode Forward Voltage (Note 2)	V _{SD}	T _J = +25°C, I _S = 3.8A, V _{GS} = 0V	-	-	1.8	V	
Reverse Recovery Time	t _{rr}	T _J = +25°C, I _F = 3.8A, dI _F /dt = 100A/μs	81	180	370	ns	
Reverse Recovered Charge	Q _{RR}	T _J = +25°C, I _F = 3.8A, dI _F /dt = 100A/μs	0.44	0.93	2.0	μC	
Forward Turn-on Time	t _{ON}	Intrinsic turn-on time is negligible. Turn-on speed is substantially controlled by L _S + L _D .	-	-	-	-	

NOTES: 1. T_J = +25°C to +150°C

2. Pulse Test: Pulse width ≤ 300μs, Duty Cycle ≤ 2%

3. Repetitive Rating: Pulse width limited by max. junction temperature. See Transient Thermal Impedance Curve (Figure 5)

4. V_{DD} = 20V, starting T_J = +25°C, L = 3.37mH, R_{GS} = 50Ω, I_{PEAK} = 9A. See Figure 15.

IRF624, IRF625, IRF626, IRF627

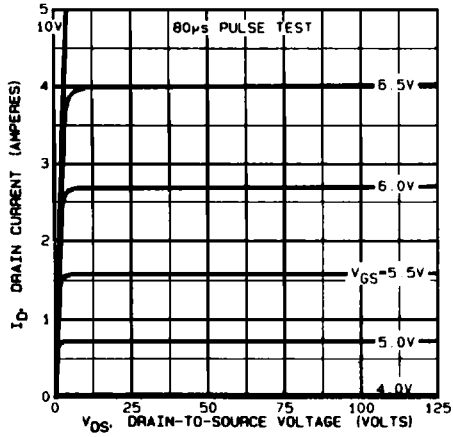


Fig. 1 — Typical Output Characteristics

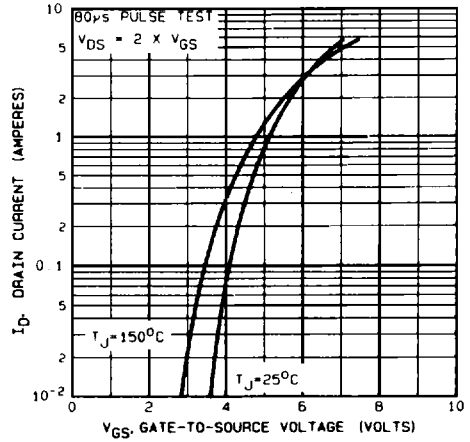


Fig. 2 — Typical Transfer Characteristics

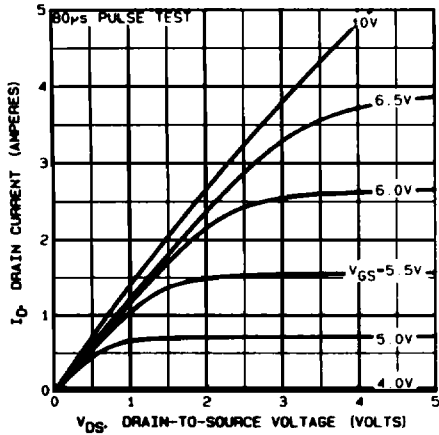


Fig. 3 — Typical Saturation Characteristics

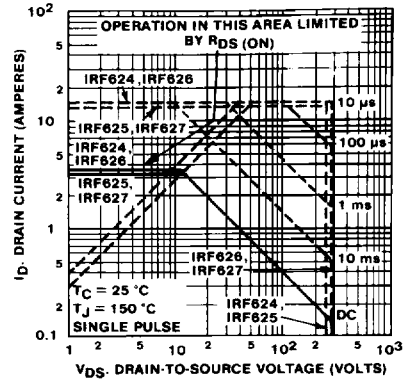


Fig. 4 — Maximum Safe Operating Area

IRF624, IRF625, IRF626, IRF627

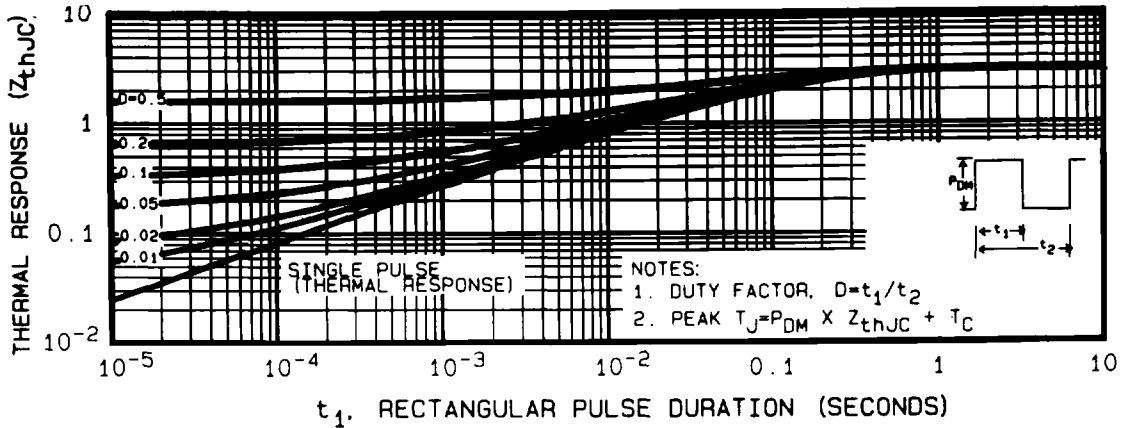


Fig. 5 — Maximum Effective Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration

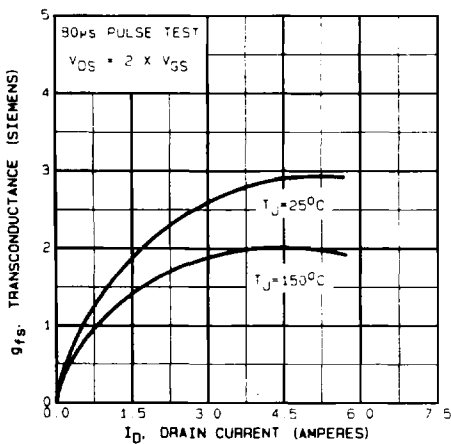


Fig. 6 — Typical Transconductance Vs. Drain Current

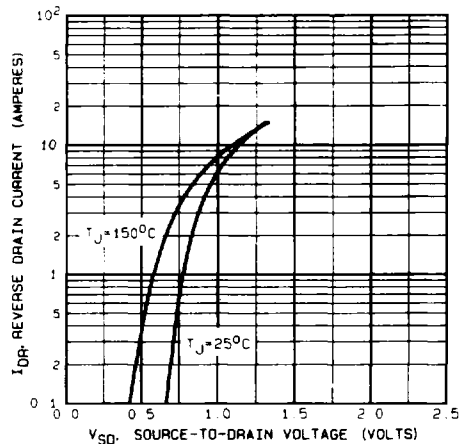


Fig. 7 — Typical Source-Drain Diode Forward Voltage

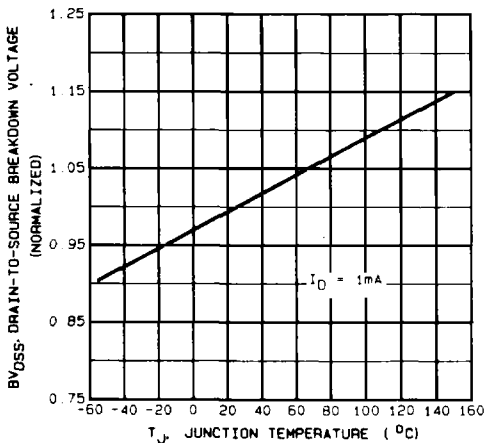


Fig. 8 — Breakdown Voltage Vs. Temperature

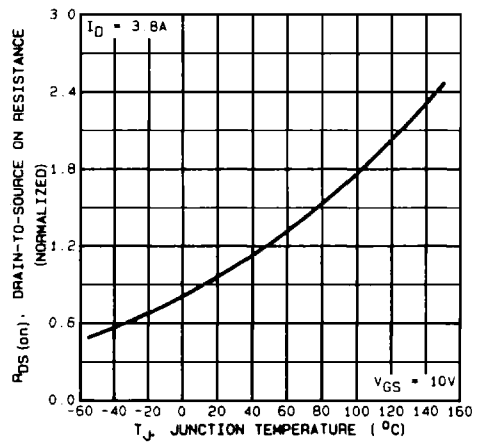


Fig. 9 — Normalized On-Resistance Vs. Temperature

IRF624, IRF625, IRF626, IRF627

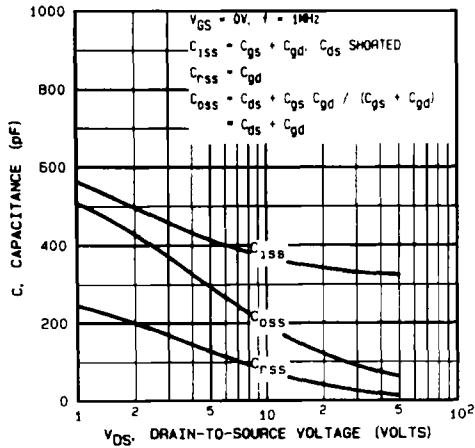


Fig. 10 — Typical Capacitance Vs. Drain-to-Source Voltage

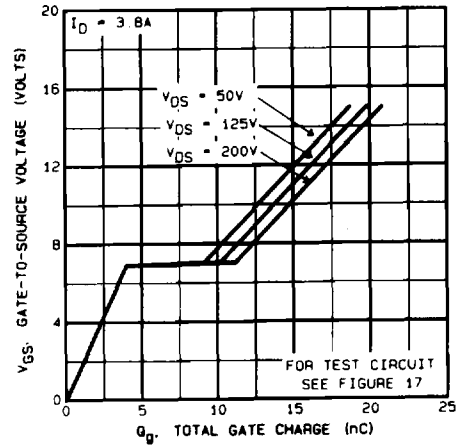


Fig. 11 — Typical Gate Charge Vs. Gate-to-Source Voltage

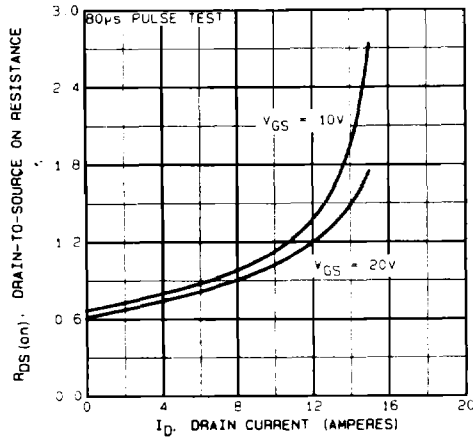


Fig. 12 — Typical On-Resistance Vs. Drain Current

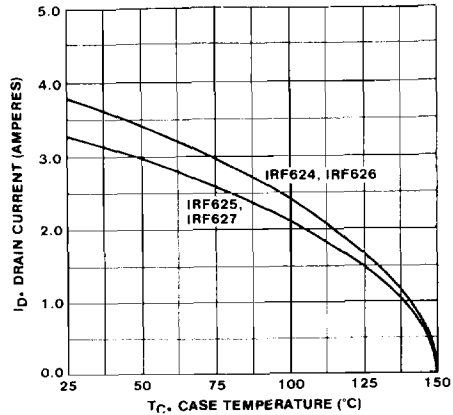


Fig. 13 — Maximum Drain Current Vs. Case Temperature

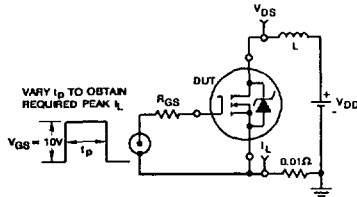


Fig. 14 — Unclamped Energy Test Circuit

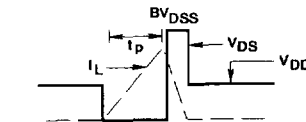


Fig. 15 — Unclamped Energy Waveforms

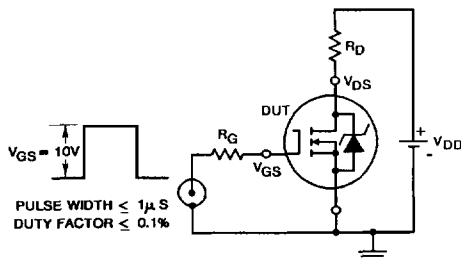


Fig. 16 — Switching Time Test Circuit

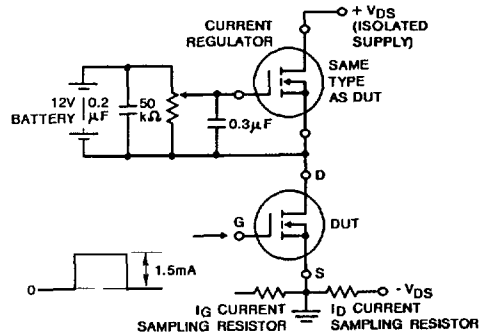


Fig. 17 — Gate Charge Test Circuit