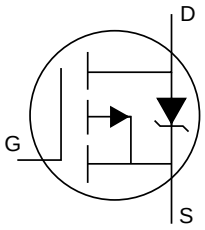
Description

The TO-220 package is universally preferred for all commercial-industrial applications at power dissipation levels to approximately 50 watts. The low thermal resistance and low package cost of the TO-220 contribute to its wide acceptance throughout the industry.



Features

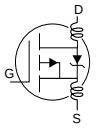
- V_{DS} (V) =-55V
- I_D = -12A (V_{GS} = -10V)
- $R_{DS(ON)}$ < 170mΩ (V_{GS} = -10V)

Absolute Maximum Ratings

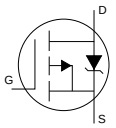
	Parameter	Max.	Units
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ -10V	-12	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ -10V	-8.5	
I_{DM}	Pulsed Drain Current ①	-48	
P_D @T_C = 25°C	Power Dissipation	45	W
	Linear Derating Factor	0.30	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy②	96	mJ
I_{AR}	Avalanche Current①	-7.2	A
E_{AR}	Repetitive Avalanche Energy①	4.5	mJ
dv/dt	Peak Diode Recovery dv/dt ③	-5.0	V/ns
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 175	°C
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	
	Mounting torque, 6-32 or M3 screw	10 lbf•in (1.1N•m)	

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case		3.3	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.50		
$R_{\theta JA}$	Junction-to-Ambient		62	

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	-55			V	V_{GS} = 0V, I_D = -250μA
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient		-0.05		V/°C	Reference to 25°C, I_D = -1mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance			175	mΩ	V_{GS} = -10V, I_D = -7.2A ④
$V_{GS(th)}$	Gate Threshold Voltage	-2.0		-4.0	V	V_{DS} = V_{GS}, I_D = -250μA
g_{fs}	Forward Transconductance	2.5			S	V_{DS} = -25V, I_D = -7.2A
I_{DSS}	Drain-to-Source Leakage Current			-25	μA	V_{DS} = -55V, V_{GS} = 0V
				-250		V_{DS} = -44V, V_{GS} = 0V, T_J = 150°C
I_{GSS}	Gate-to-Source Forward Leakage			100	nA	V_{GS} = 20V
	Gate-to-Source Reverse Leakage			-100		V_{GS} = -20V
Q_g	Total Gate Charge			19	nC	I_D = -7.2A
Q_{gs}	Gate-to-Source Charge			5.1		V_{DS} = -44V
Q_{gd}	Gate-to-Drain ("Miller") Charge			10		V_{GS} = -10V, See Fig. 6 and 13 ④
$t_{d(on)}$	Turn-On Delay Time		13		ns	V_{DD} = -28V
t_r	Rise Time		55			I_D = -7.2A
$t_{d(off)}$	Turn-Off Delay Time		23			R_G = 24Ω
t_f	Fall Time		37			R_D = 3.7Ω, See Fig. 10 ④
L_D	Internal Drain Inductance		4.5		nH	Between lead, 6mm (0.25in.) from package and center of die contact 
L_S	Internal Source Inductance		7.5			
C_{iss}	Input Capacitance		350		pF	V_{GS} = 0V
C_{oss}	Output Capacitance		170			V_{DS} = -25V
C_{rss}	Reverse Transfer Capacitance		92			f = 1.0MHz, See Fig. 5

Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)			-12	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ①			-48		
V_{SD}	Diode Forward Voltage			-1.6	V	T_J = 25°C, I_S = -7.2A, V_{GS} = 0V ④
t_{rr}	Reverse Recovery Time		47	71	ns	T_J = 25°C, I_F = -7.2A
Q_{rr}	Reverse RecoveryCharge		84	130	μC	di/dt = -100A/μs ④
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by L_S+L_D)				

Notes:

① Repetitive rating; pulse width limited by max. junction temperature. (See fig. 11)

② Starting T_J = 25°C, L = 3.7mH R_G = 25Ω, I_{AS} = -7.2A. (See Figure 12)

③ I_{SD} ≤ -7.2A, di/dt ≤ -280A/μs, V_{DD} ≤ $V_{(BR)DSS}$, T_J ≤ 175°C

④ Pulse width ≤ 300μs; duty cycle ≤ 2%.

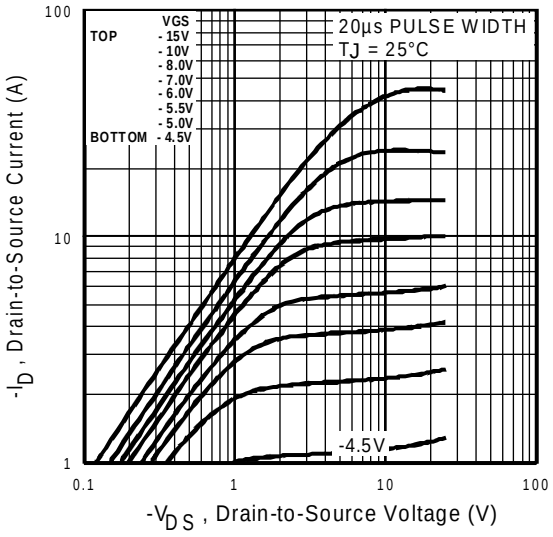


Fig 1. Typical Output Characteristics,

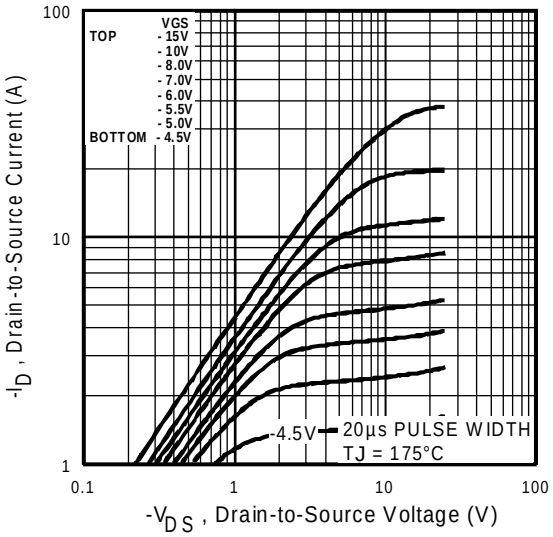


Fig 2. Typical Output Characteristics,

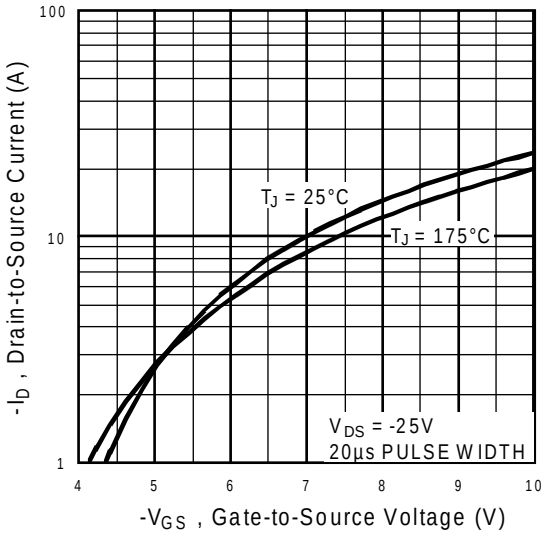


Fig 3. Typical Transfer Characteristics

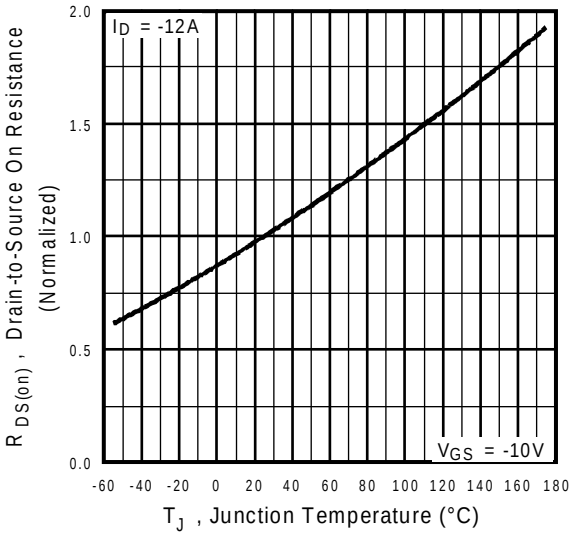


Fig 4. Normalized On-Resistance Vs. Temperature

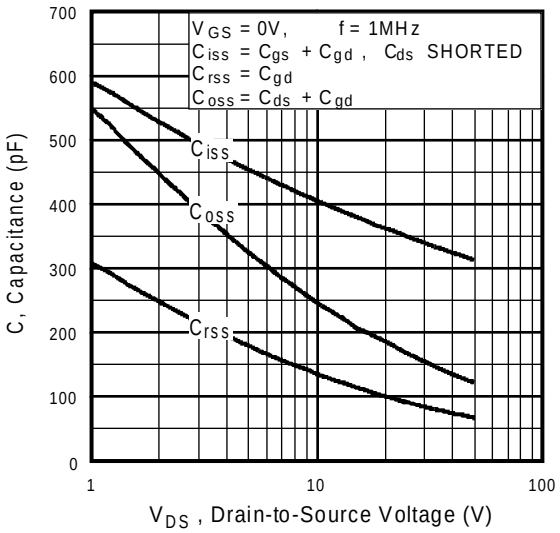


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

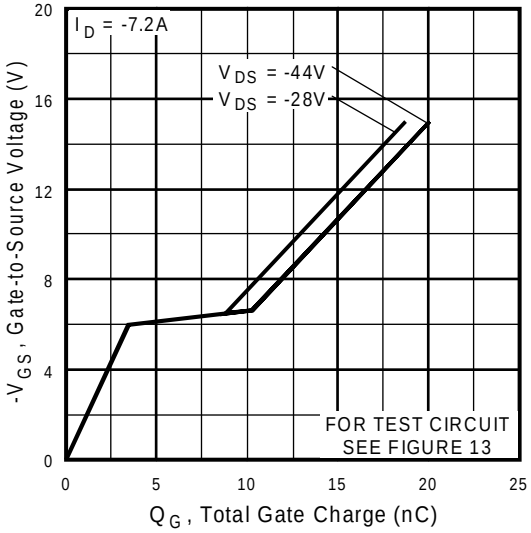


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

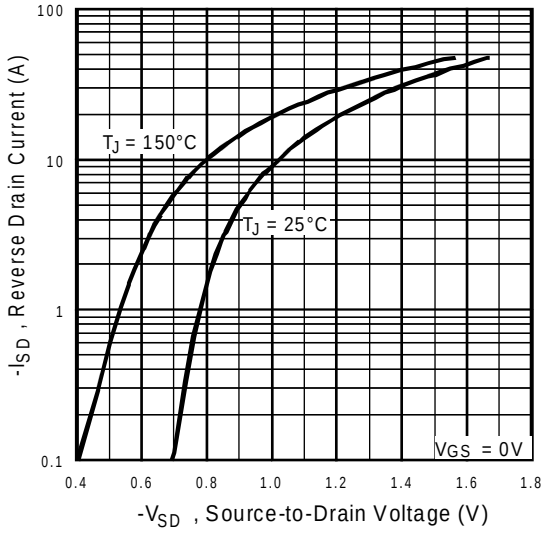


Fig 7. Typical Source-Drain Diode Forward Voltage

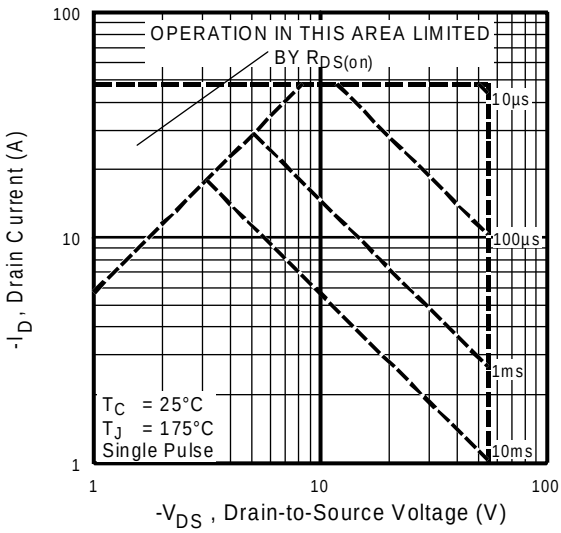


Fig 8. Maximum Safe Operating Area

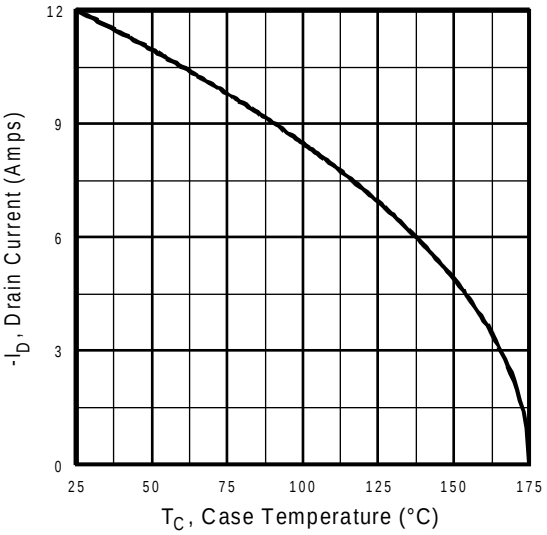


Fig 9. Maximum Drain Current Vs. Case Temperature

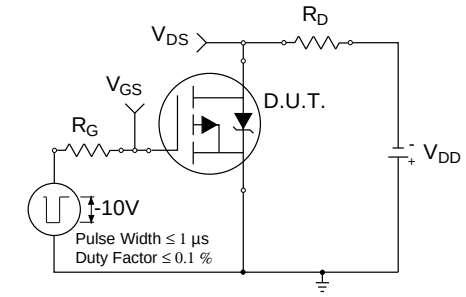


Fig 10a. Switching Time Test Circuit

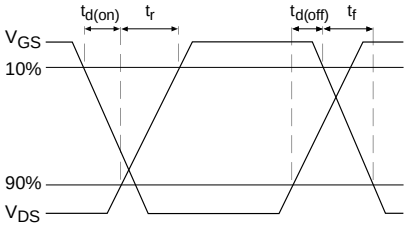


Fig 10b. Switching Time Waveforms

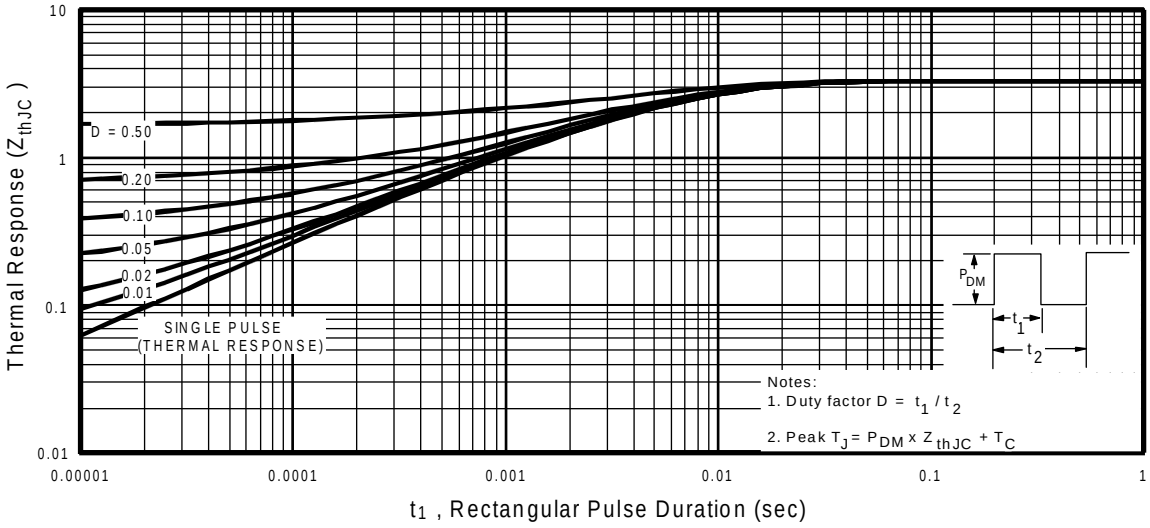


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

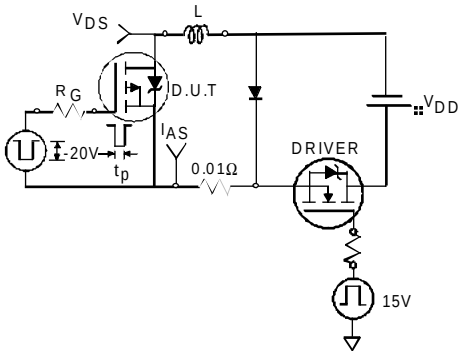


Fig 12a. Unclamped Inductive Test Circuit

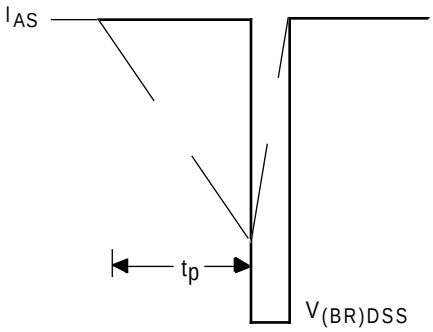


Fig 12b. Unclamped Inductive Waveforms

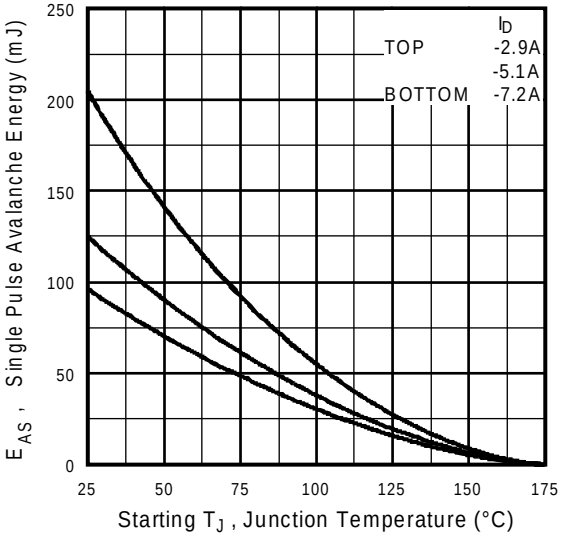


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

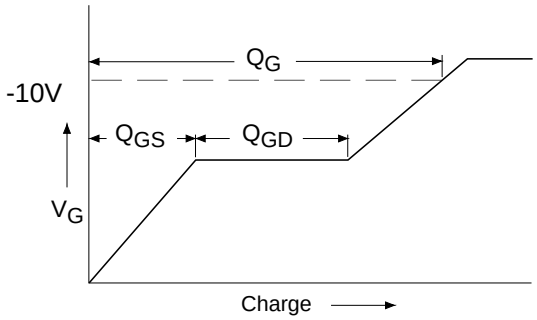


Fig 13a. Basic Gate Charge Waveform

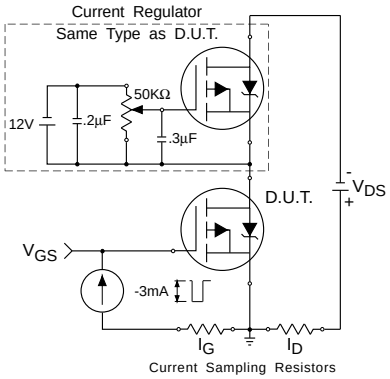
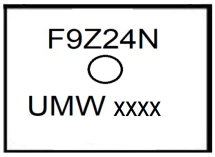


Fig 13b. Gate Charge Test Circuit

Package Mechanical Data TO-220

Marking



Ordering information

Order code	Package	Baseqty	Deliverymode
UMW IRF9Z24N	TO-220	1000	Tube and box

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