

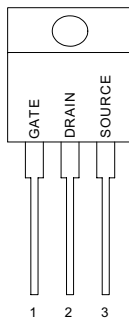
APPLICATION

- ◆ Fast Switching
- ◆ Simple Drive Requirement
- ◆ Low Gate Charge

V_{DSS}	$R_{DS(ON) Max.}$	I_D
30V	17.0mΩ	40A

PIN CONFIGURATION

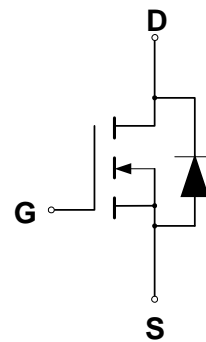
TO-220
Front View



FEATURES

- ◆ Low ON Resistance
- ◆ Low Gate Charge
- ◆ Peak Current vs Pulse Width Curve
- ◆ Inductive Switching Curves

SYMBOL



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain to Source Voltage (Note 1)	V_{DSS}	30	V
Drain to Current – Continuous $T_c = 25^\circ C, V_{GS}@10V$	I_D	40	A
	I_D	30	
	I_{DM}	170	
– Continuous $T_c = 100^\circ C, V_{GS}@10V$			
– Pulsed $T_c = 25^\circ C, V_{GS}@10V$ (Note 2)			
Gate-to-Source Voltage – Continue	V_{GS}	± 20	V
Total Power Dissipation	P_D	50	W
		0.4	W/ $^\circ C$
Derating Factor above $25^\circ C$			
Peak Diode Recovery dv/dt (Note 3)	dv/dt	4.5	V/ns
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 175	$^\circ C$
Single Pulse Avalanche Energy $L=144\mu H, I_D=40$ Amps	E_{AS}	500	mJ
Maximum Lead Temperature for Soldering Purposes	T_L	300	$^\circ C$
Maximum Package Body for 10 seconds	T_{PKG}	260	$^\circ C$
Pulsed Avalanche Rating	I_{AS}	60	A

THERMAL RESISTANCE

Symbol	Parameter	Min	Typ	Max	Units	Test Conditions
$R_{\theta JC}$	Junction-to-case			2.5	$^\circ C$	Water cooled heatsink, P_D adjusted for a peak junction temperature of $+175^\circ C$
$R_{\theta JA}$	Junction-to-ambient			62	$^\circ C/W$	1 cubic foot chamber, free air

ORDERING INFORMATION

Part Number	Package
IRF40N03	TO-220

ELECTRICAL CHARACTERISTICS

Unless otherwise specified, $T_J = 25^\circ\text{C}$.

Characteristic		Symbol	IRF40N03			Units
			Min	Typ	Max	
OFF Characteristics						
Drain-to-Source Breakdown Voltage ($V_{GS} = 0\text{ V}$, $I_D = 250\ \mu\text{A}$)		V_{DSS}	30			V
Breakdown Voltage Temperature Coefficient (Reference to 25°C , $I_D = 1\text{mA}$)		$\Delta V_{DSS}/\Delta T_J$		0.037		$\text{V}/^\circ\text{C}$
Drain-to-Source Leakage Current ($V_{DS} = 30\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 25^\circ\text{C}$) ($V_{DS} = 24\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 150^\circ\text{C}$)		I_{DSS}			1 25	μA
Gate-to-Source Forward Leakage ($V_{GS} = 20\text{ V}$)		I_{GSS}			100	nA
Gate-to-Source Reverse Leakage ($V_{GS} = -20\text{ V}$)		I_{GSS}			-100	nA
ON Characteristics						
Gate Threshold Voltage ($V_{DS} = V_{GS}$, $I_D = 250\ \mu\text{A}$)		$V_{GS(th)}$	1.0	2.0	3.0	V
Static Drain-to-Source On-Resistance (Note 4) ($V_{GS} = 10\text{ V}$, $I_D = 20\text{A}$)		$R_{DS(on)}$		14	17	m Ω
Forward Transconductance ($V_{DS} = 10\text{ V}$, $I_D = 20\text{A}$) (Note 4)		g_{FS}		26		S
Dynamic Characteristics						
Input Capacitance	$(V_{DS} = 25\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1.0\text{ MHz}$)	C_{iss}		800		pF
Output Capacitance		C_{oss}		380		pF
Reverse Transfer Capacitance		C_{rss}		133		pF
Total Gate Charge ($V_{GS} = 10\text{ V}$)	$(V_{DS} = 24\text{ V}$, $I_D = 20\text{ A}$, $V_{GS} = 5\text{ V}$) (Note 5)	Q_g		17		nC
Gate-to-Source Charge		Q_{gs}		3		nC
Gate-to-Drain ("Miller") Charge		Q_{gd}		10		nC
Resistive Switching Characteristics						
Turn-On Delay Time	$(V_{DS} = 15\text{ V}$, $I_D = 20\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 3.3\ \Omega$) (Note 5)	$t_{d(on)}$		7.2		ns
Rise Time		t_{rise}		60		ns
Turn-Off Delay Time		$t_{d(off)}$		22.5		ns
Fall Time		t_{fall}		10		ns
Source-Drain Diode Characteristics						
Continuous Source Current (Body Diode)	Integral pn-diode in MOSFET	I_S			40	A
Pulse Source Current (Body Diode)		I_{SM}			170	A
Diode Forward On-Voltage	$(I_S = 40\text{ A}$, $V_{GS} = 0\text{ V}$)	V_{SD}			1.3	V
Reverse Recovery Time	$(I_F = 40\text{ A}$, $V_{GS} = 0\text{ V}$, $d_i/d_t = 100\text{A}/\mu\text{s}$)	t_{rr}		55		ns
Reverse Recovery Charge		Q_{rr}		110		nC

Note 1: $T_J = +25^\circ\text{C}$ to 150°C

Note 2: Repetitive rating; pulse width limited by maximum junction temperature.

Note 3: $I_{SD} = 12.0\text{A}$, $d_i/d_t \leq 100\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, $T_J = +150^\circ\text{C}$

Note 4: Pulse width $\leq 250\ \mu\text{s}$; duty cycle $\leq 2\%$

Note 5: Essentially independent of operating temperature.

TYPICAL ELECTRICAL CHARACTERISTICS

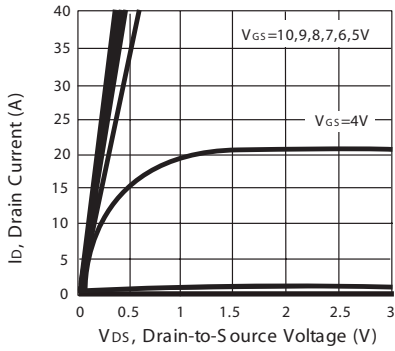


Figure 1. Output Characteristics

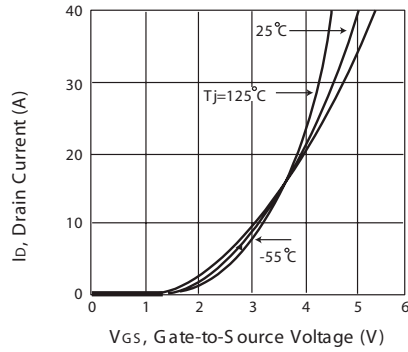


Figure 2. Transfer Characteristics

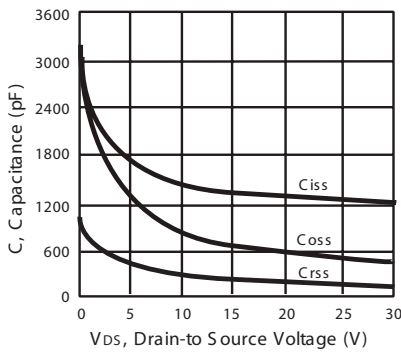


Figure 3. Capacitance

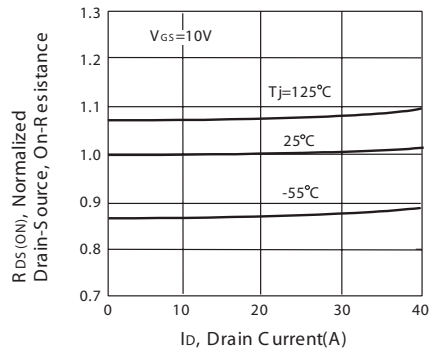


Figure 4. On-Resistance Variation with Drain Current and Temperature

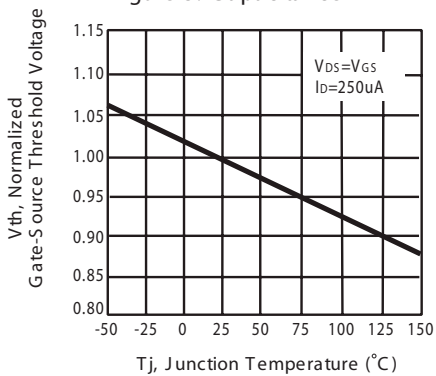


Figure 5. Gate Threshold Variation with Temperature

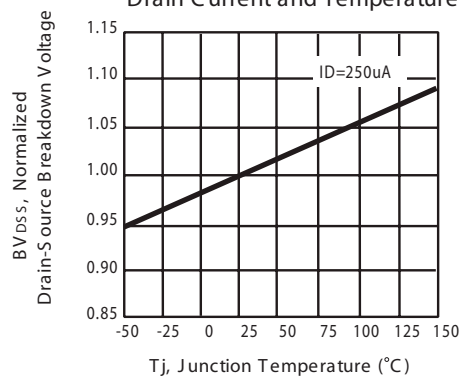


Figure 6. Breakdown Voltage Variation with Temperature

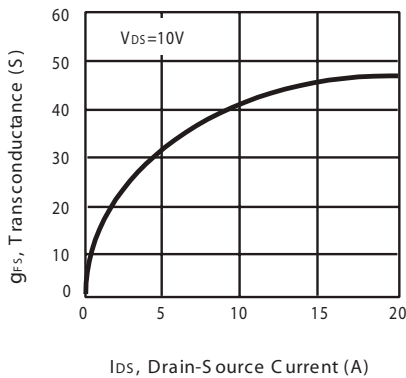


Figure 7. Transconductance Variation with Drain Current

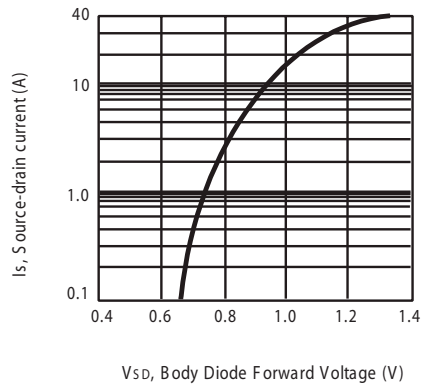


Figure 8. Body Diode Forward Voltage Variation with Source Current

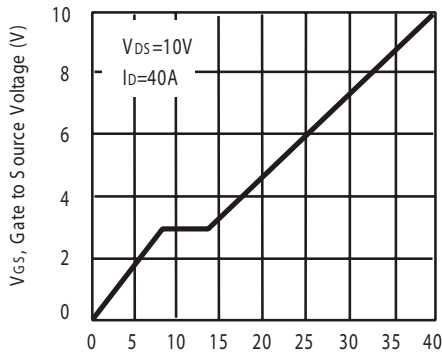


Figure 9. Gate Charge

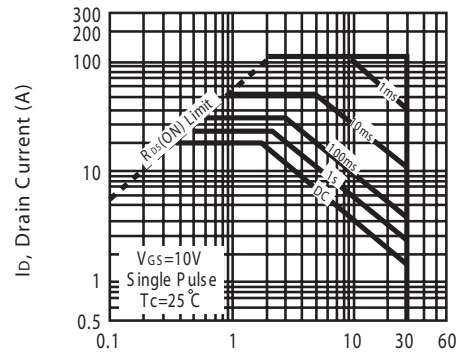


Figure 10. Maximum Safe Operating Area

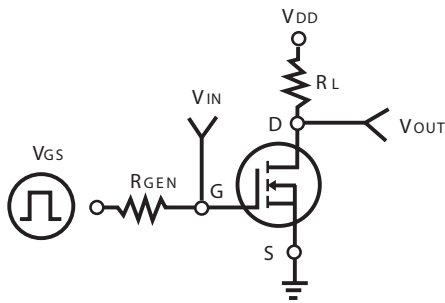


Figure 11. Switching Test Circuit

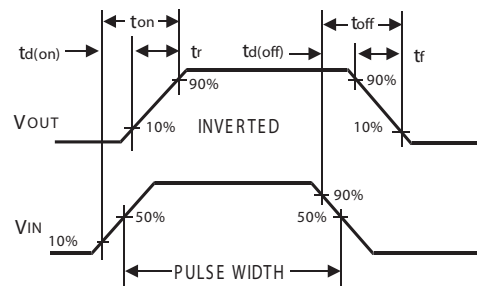


Figure 12. Switching Waveforms

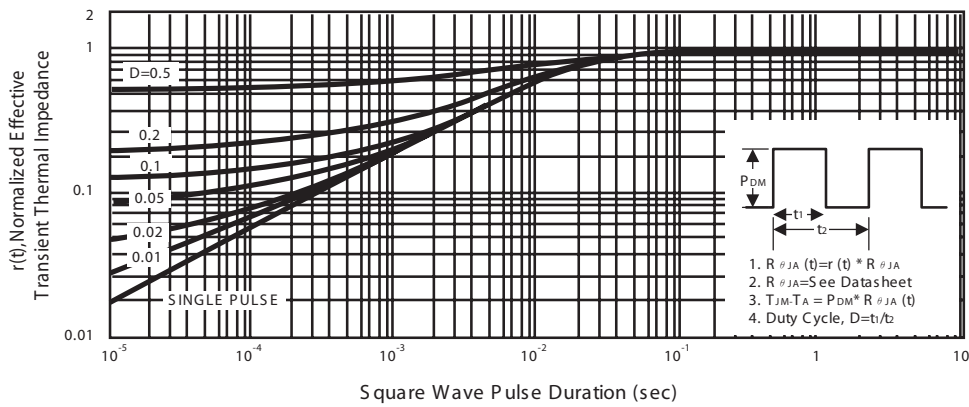


Figure 13. Normalized Thermal Transient Impedance Curve