

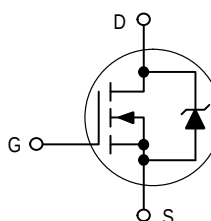
Product Preview

TMOS E-FET™

Power Field Effect Transistor N-Channel Enhancement-Mode Silicon Gate

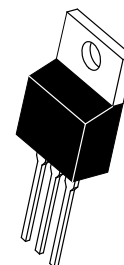
This advanced TMOS power FET is designed to withstand high energy in the avalanche and commutation modes. This new energy efficient design also offers a drain-to-source diode with a fast recovery time. Designed for low voltage, high speed switching applications in power supplies, converters, and PWM motor controls. These devices are particularly well suited for bridge circuits where diode speed and commutating safe operating area are critical and offer additional safety margin against unexpected voltage transients.

- Avalanche Energy Specified
- Source-to-Drain Diode Recovery Time Comparable to a Discrete Fast Recovery Diode
- Diode is Characterized for Use in Bridge Circuits
- I_{DSS} and $V_{DS(on)}$ Specified at Elevated Temperature



IRF540

TMOS POWER FET
27 AMPERES
100 VOLTS
 $R_{DS(on)} = 0.070 \text{ OHMS}$



CASE 221A-09
TO-220AB

MAXIMUM RATINGS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Rating	Symbol	Value	Unit
Drain-to-Source Voltage	V_{DSS}	100	Vdc
Drain-to-Gate Voltage ($R_{GS} = 1.0 \text{ M}\Omega$)	V_{DGR}	100	Vdc
Gate-to-Source Voltage — Continuous — Non-repetitive ($t_p \leq 10 \text{ ms}$)	V_{GS} V_{GSM}	± 20 ± 40	Vdc Vpk
Drain Current — Continuous — Continuous @ 100°C — Single Pulse ($t_p \leq 10 \mu\text{s}$)	I_D I_D I_{DM}	27 19 95	Adc Adc Apk
Total Power Dissipation Derate above 25°C	P_D	145 1.16	Watts W/ $^\circ\text{C}$
Operating and Storage Temperature Range	T_J, T_{stg}	-55 to 150	$^\circ\text{C}$
Single Pulse Drain-to-Source Avalanche Energy — STARTING $T_J = 25^\circ\text{C}$ ($V_{DD} = 50 \text{ Vdc}$, $V_{GS} = 10 \text{ Vdc}$, PEAK $I_L = 27 \text{ Apk}$, $L = 1.0 \text{ mH}$, $R_G = 25 \Omega$)	E_{AS}	365	mJ
Thermal Resistance — Junction-to-Case — Junction-to-Ambient	$R_{\theta JC}$ $R_{\theta JA}$	0.86 62.5	$^\circ\text{C/W}$
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds	T_L	260	$^\circ\text{C}$

This document contains information on a product under development. Motorola reserves the right to change or discontinue this product without notice.

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IRF540

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage (V _{GS} = 0 Vdc, I _D = 0.25 mAdc) Temperature Coefficient (Positive)	V _{(BR)DSS}	100 —	— 116	— —	Vdc mV/°C
Zero Gate Voltage Drain Current (V _{DS} = 100 Vdc, V _{GS} = 0 Vdc) (V _{DS} = 100 Vdc, V _{GS} = 0 Vdc, T _J = 125°C)	I _{DSS}	— —	— —	10 100	μAdc
Gate-Body Leakage Current (V _{GS} = ±20 Vdc, V _{DS} = 0 Vdc)	I _{GSS}	—	—	100	nAdc

ON CHARACTERISTICS(1)

Gate Threshold Voltage (V _{DS} = V _{GS} , I _D = 250 μAdc) Threshold Temperature Coefficient (Negative)	Cpk ≥ 2.0(3)	V _{GS(th)}	2.0 —	2.9 6.8	4.0 —	Vdc mV/°C
Static Drain-to-Source On-Resistance (V _{GS} = 10 Vdc, I _D = 15 Adc)	Cpk ≥ 2.0(3)	R _{DS(on)}	—	0.047	0.070	Ohms
Drain-to-Source On-Voltage (V _{GS} = 10 Vdc, I _D = 27 Adc) (V _{GS} = 10 Vdc, I _D = 15 Adc, T _J = 125°C)		V _{DS(on)}	— —	— —	1.9 1.8	Vdc
Forward Transconductance (V _{DS} = 15 Vdc, I _D = 15 Adc)		g _{FS}	6.0	15	—	Mhos

DYNAMIC CHARACTERISTICS

Input Capacitance	(V _{DS} = 25 Vdc, V _{GS} = 0 Vdc, f = 1.0 MHz)	C _{iss}	—	1460	1600	pF
Output Capacitance		C _{oss}	—	390	800	
Transfer Capacitance		C _{rss}	—	120	300	

SWITCHING CHARACTERISTICS(2)

Turn-On Delay Time	(V _{DD} = 30 Vdc, I _D = 15 Adc, V _{GS} = 10 Vdc, R _G = 4.7 Ω)	t _{d(on)}	—	11.6	30	ns
Rise Time		t _r	—	50	60	
Turn-Off Delay Time		t _{d(off)}	—	26	80	
Fall Time		t _f	—	19	30	
Gate Charge (See Figure 8)	(V _{DS} = 80 Vdc, I _D = 27 Adc, V _{GS} = 10 Vdc)	Q _T	—	50	60	nC
		Q ₁	—	9.0	—	
		Q ₂	—	26	—	
		Q ₃	—	20	—	

SOURCE-DRAIN DIODE CHARACTERISTICS

Forward On-Voltage (I _S = 27 Adc, V _{GS} = 0 Vdc) (I _S = 27 Adc, V _{GS} = 0 Vdc, T _J = 125°C)	V _{SD}	— —	0.93 0.84	2.4 —	Vdc
Reverse Recovery Time	(I _S = 27 Adc, V _{GS} = 0 Vdc, dI _S /dt = 100 A/μs)	t _{rr}	—	110	ns
		t _a	—	100	
		t _b	—	10	
Reverse Recovery Stored Charge		Q _{RR}	—	0.67	μC

INTERNAL PACKAGE INDUCTANCE

Internal Drain Inductance (Measured from the contact screw on tab to center of die) (Measured from the drain lead 0.25" from package to center of die)	L _d	— —	3.5 4.5	— —	nH
Internal Source Inductance (Measured from the source lead 0.25" from package to source bond pad)	L _s	—	7.5	—	

(1) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

(2) Switching characteristics are independent of operating junction temperature.

(3) Reflects typical values. $C_{pk} = \frac{|\text{Max limit} - \text{Typ}|}{3 \times \text{sigma}}$

TYPICAL ELECTRICAL CHARACTERISTICS

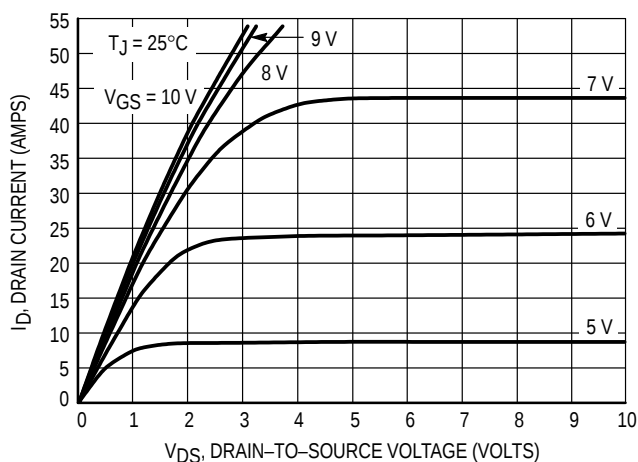


Figure 1. On-Region Characteristics

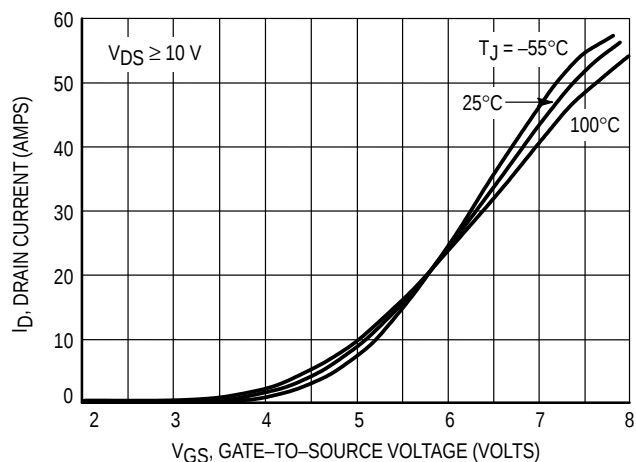


Figure 2. Transfer Characteristics

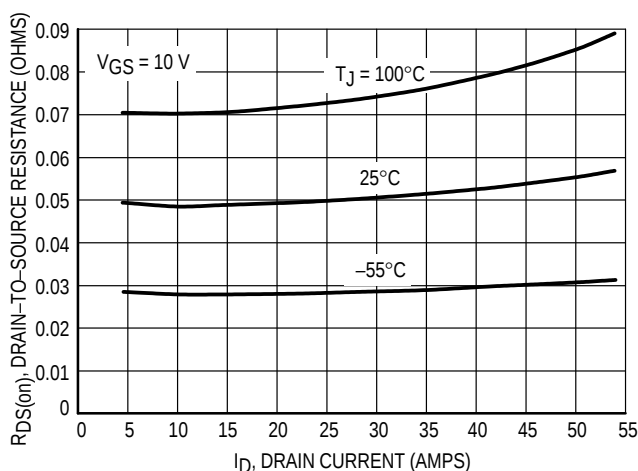


Figure 3. On-Resistance versus Drain Current and Temperature

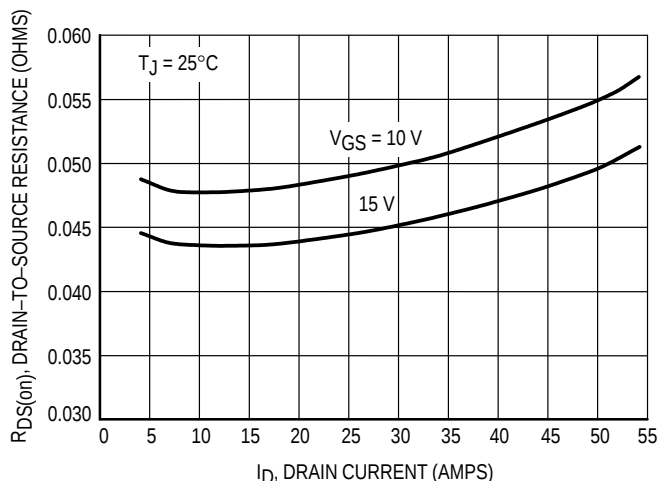


Figure 4. On-Resistance versus Drain Current and Gate Voltage

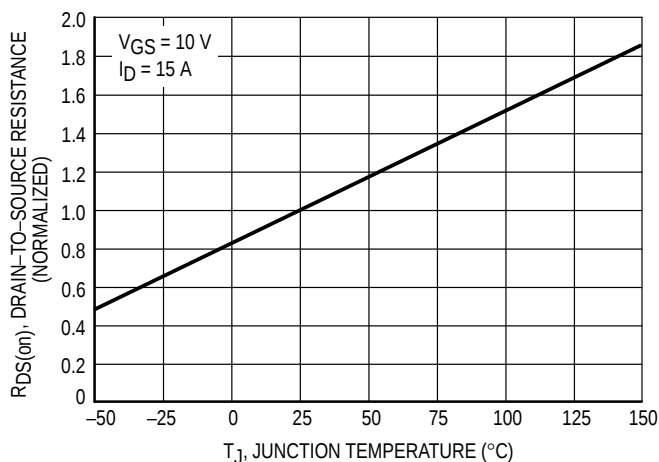


Figure 5. On-Resistance Variation with Temperature

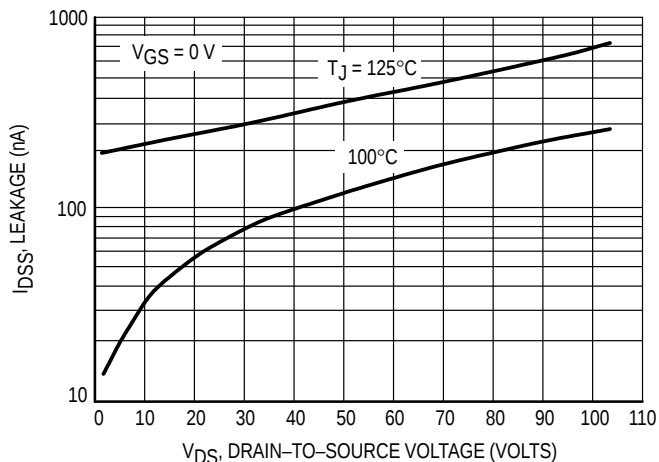


Figure 6. Drain-to-Source Leakage Current versus Voltage

TYPICAL ELECTRICAL CHARACTERISTICS

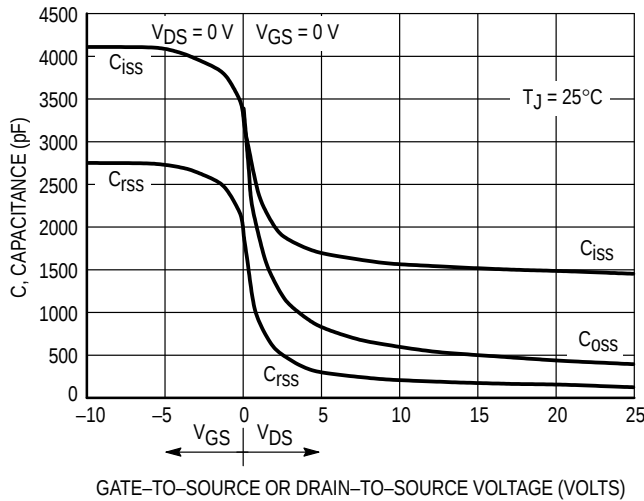


Figure 7. Capacitance Variation

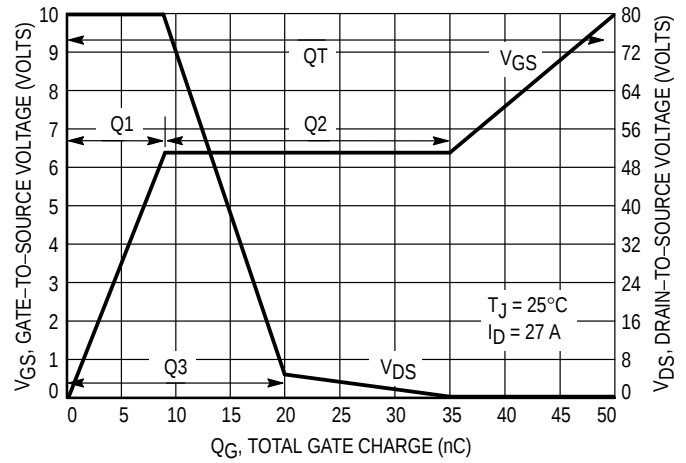


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

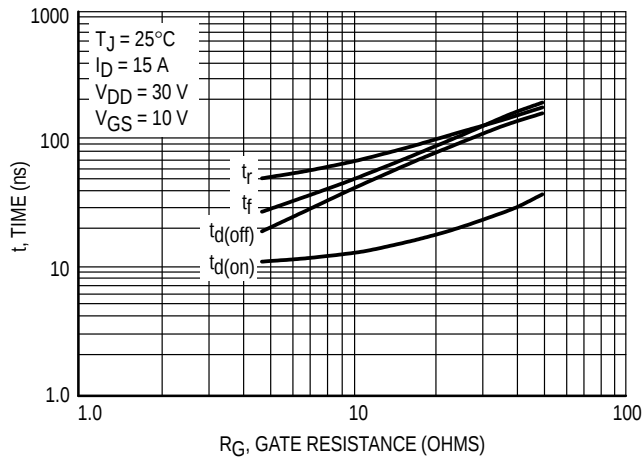


Figure 9. Resistive Switching Time Variation versus Gate Resistance

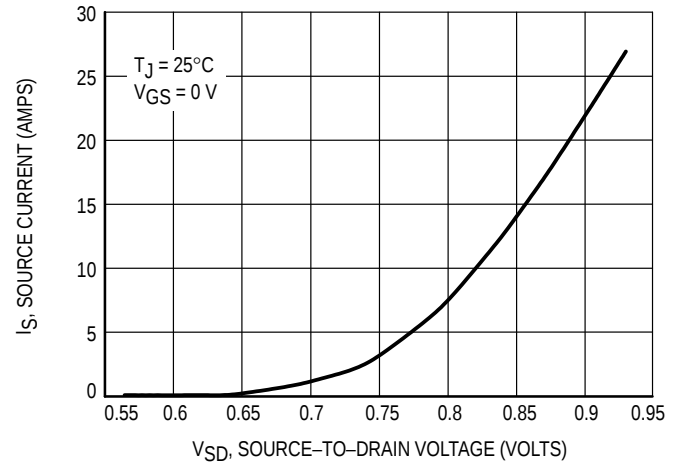


Figure 10. Diode Forward Voltage versus Current

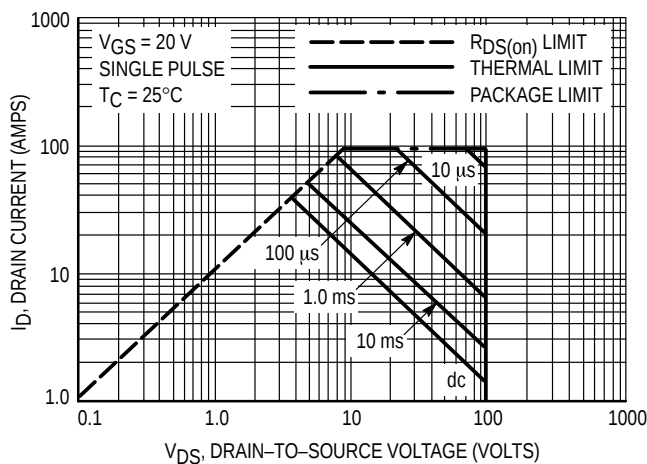


Figure 11. Maximum Rated Forward Biased Safe Operating Area

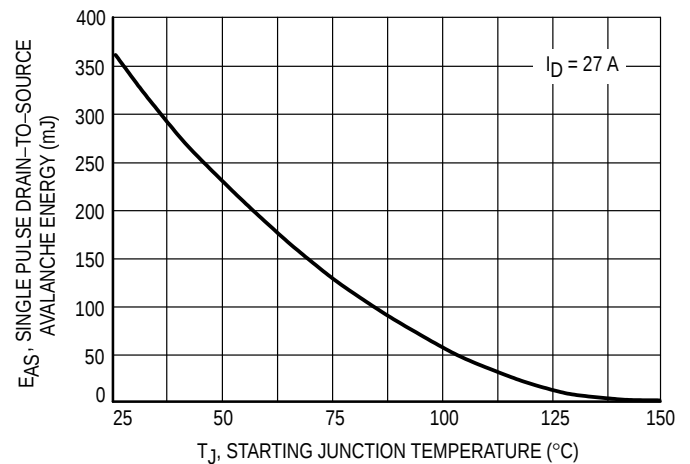


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

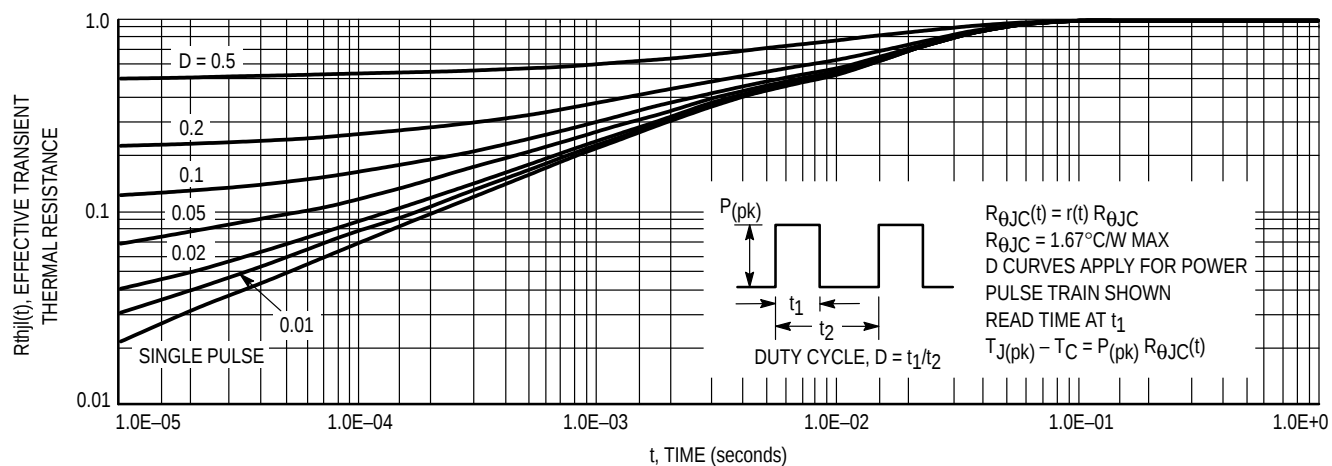
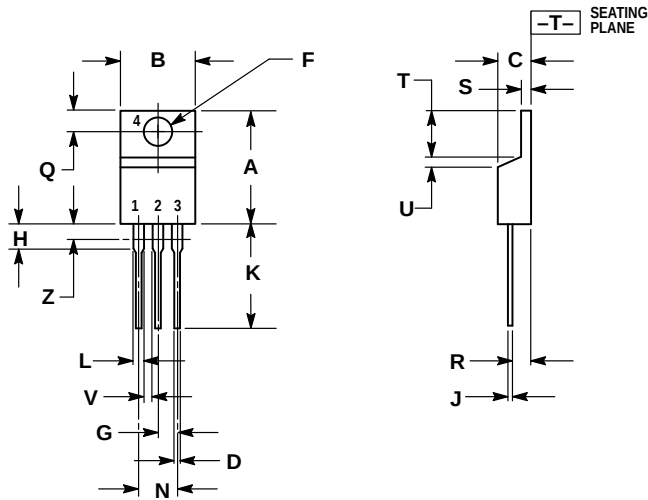


Figure 13. Thermal Response

PACKAGE DIMENSIONS



**CASE 221A-09
(TO-220AB)
ISSUE Z**

- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.
 3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.570	0.620	14.48	15.75
B	0.380	0.405	9.66	10.28
C	0.160	0.190	4.07	4.82
D	0.025	0.035	0.64	0.88
F	0.142	0.147	3.61	3.73
G	0.095	0.105	2.42	2.66
H	0.110	0.155	2.80	3.93
J	0.018	0.025	0.46	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.39
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	—	1.15	—
Z	—	0.080	—	2.04

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