

MOTOROLA

SEMICONDUCTOR

TECHNICAL DATA

Advance Information

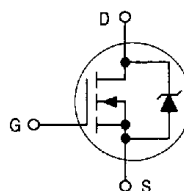
TMOS E-FET™

Power Field Effect Transistor

N-Channel Enhancement-Mode Silicon Gate

This advanced TMOS E-FET is designed to withstand high energy in the avalanche and commutation modes. The 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 areas are critical and offer additional safety margin against unexpected voltage transients.

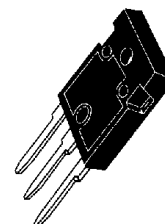
- Avalanche Energy Specified
- Source-to-Drain Diode Recovery Time Comparable to a Discrete Fast Recovery Diode
- Diode is Characterized for Use in Bridge Circuits
- I_{DSS} and $V_{DS(on)}$ Specified at Elevated Temperature



MTW54N05E

Motorola Preferred Device

TMOS POWER FET
54 AMPERES
 $R_{DS(on)} = 0.014 \text{ OHM}$
50 Volts



CASE 340F-03
TO-247AE

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

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	50	Vdc
Drain-Gate Voltage ($R_{GS} = 1.0 \text{ M}\Omega$)	V_{DGR}	50	Vdc
Gate-Source Voltage — Continuous	V_{GS}	± 20	Vdc
Drain Current — Continuous @ $T_C = 25^\circ\text{C}$	I_D	54	Adc
— Continuous @ $T_C = 100^\circ\text{C}$	I_D	37	
— Single Pulse ($t_p \leq 10 \mu\text{s}$)	I_{DM}	220	Apk
Total Power Dissipation @ $T_C = 25^\circ\text{C}$	P_D	210	Watts
Derate above 25°C		1.43	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 $T_J = 25^\circ\text{C}$ ($V_{DD} = 50 \text{ Vdc}$, $V_{GS} = 10 \text{ Vpk}$, $I_L = 54 \text{ Apk}$, $L = 0.44 \text{ mH}$, $R_G = 25 \Omega$)	E_{AS}	640	mJ
Thermal Resistance — Junction to Case	$R_{\theta JC}$	0.7	$^\circ\text{C/W}$
— Junction to Ambient	$R_{\theta JA}$	80	
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds	T_L	260	$^\circ\text{C}$

This document contains information on a new product. Specifications and information are subject to change without notice.

E-FET is a trademark of Motorola Inc.

TMOS is a registered trademark of Motorola Inc.

Preferred devices are Motorola recommended choices for future use and best overall value.

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

Characteristic	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-Source Breakdown Voltage ($V_{GS} = 0\text{ V}$, $I_D = 250\text{ }\mu\text{A}$) Temperature Coefficient (Positive)	BV_{DSS}	50	—	—	Vdc mV/ $^\circ\text{C}$
Zero Gate Voltage Drain Current ($V_{DS} = 50\text{ Vdc}$, $V_{GS} = 0$) ($V_{DS} = 40\text{ Vdc}$, $V_{GS} = 0$, $T_J = 125^\circ\text{C}$)	I_{DSS}	—	—	10 100	μA
Gate-Body Leakage Current ($V_{GS} = \pm 20\text{ Vdc}$, $V_{DS} = 0$)	I_{GSS}	—	—	100	nA

ON CHARACTERISTICS*

Gate Threshold Voltage ($V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$) Temperature Coefficient (Negative) ($T_J = 125^\circ\text{C}$)	$V_{GS(th)}$	2.0 1.5	3.0 —	4.0 3.5	Vdc mV/ $^\circ\text{C}$
Static Drain-Source On-Resistance ($V_{GS} = 10\text{ Vdc}$, $I_D = 27\text{ A}$)	$R_{DS(on)}$	—	—	0.014	Ohm
Drain-Source On-Voltage ($V_{GS} = 10\text{ Vdc}$) ($I_D = 54\text{ A}$) ($I_D = 27\text{ A}$, $T_J = 125^\circ\text{C}$)	$V_{DS(on)}$	— —	— —	1.0 0.8	Vdc
Forward Transconductance ($V_{DS} = 10\text{ Vdc}$, $I_D = 27\text{ A}$)	g_{FS}	31	—	—	mhos

DYNAMIC CHARACTERISTICS

Input Capacitance	($V_{DS} = 25\text{ Vdc}$, $V_{GS} = 0$, $f = 1.0\text{ MHz}$)	C_{iss}	—	4500	6300	pF
Output Capacitance		C_{oss}	—	2300	3200	
Reverse Transfer Capacitance		C_{rss}	—	750	1050	

SWITCHING CHARACTERISTICS*†

Turn-On Delay Time	($V_{DD} = 25\text{ Vdc}$, $I_D = 54\text{ A}$, $V_{GS} = 10\text{ Vdc}$, $R_g = 9.1\text{ }\Omega$)	$t_{d(on)}$	—	30	60	ns
Rise Time		t_r	—	280	560	
Turn-Off Delay Time		$t_{d(off)}$	—	165	330	
Fall Time		t_f	—	270	550	
Gate Charge	($V_{DS} = 40\text{ Vdc}$, $I_D = 54\text{ A}$, $V_{GS} = 10\text{ Vdc}$)	Q_g	—	150	190	nC
Gate-Source Charge		Q_{gs}	—	40	—	
Gate-Drain Charge		Q_{gd}	—	65	—	

SOURCE-DRAIN DIODE CHARACTERISTICS*

Forward On-Voltage ($I_S = 54\text{ A}$, $V_{GS} = 0$) ($I_S = 6.0\text{ A}$, $V_{GS} = 0$, $T_J = 125^\circ\text{C}$)	V_{SD}	— —	— 0.6	— 1.2	Vdc
Reverse Recovery Time ($I_S = 54\text{ A}$, $V_{GS} = 0$, $dI_S/dt = 100\text{ A}/\mu\text{s}$)	t_{rr}	—	150	—	ns

INTERNAL PACKAGE INDUCTANCE

Internal Drain Inductance (Measured from the drain lead 0.25" from package to center of die)	L_D	—	5.0	—	nH
Internal Source Inductance (Measured from the source lead 0.25" from package to source bond pad)	L_S	—	13	—	nH

*Pulse Test Pulse Width $\leq 300\text{ }\mu\text{s}$, Duty Cycle $\leq 2\%$

†Switching characteristics are independent of operating junction temperature