MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

Advance Information

TMOS E-FET ™
Power Field Effect Transistor
N-Channel Enhancement-Mode Silicon Gate

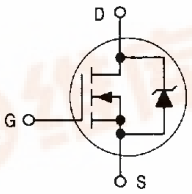
MTW54N05E
Motorola Preferred Device

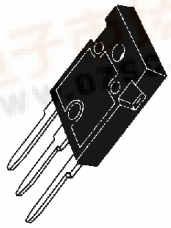
TMOS POWER FET
54 AMPERES
$R_{DS(on)}$ = 0.014 OHM
50 Volts

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

TMOS®





CASE 340F-03
TO-247AE

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MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	50	Vdc
Drain-Gate Voltage (R_{GS} = 1.0 MΩ)	V_{DGR}	50	Vdc
Gate-Source Voltage — Continuous	V_{GS}	±20	Vdc
Drain Current — Continuous @ T_C = 25°C — Continuous @ T_C = 100°C — Single Pulse ($t_p \leq 10$ µs)	I_D I_D I_{DM}	54 37 220	Adc Apk
Total Power Dissipation @ T_C = 25°C Derate above 25°C	P_D	210 1.43	Watts W/°C
Operating and Storage Temperature Range	T_J, T_{stg}	−55 to 150	°C
Single Pulse Drain-to-Source Avalanche Energy — Starting T_J = 25°C (V_{DD} = 50 Vdc, V_{GS} = 10 Vpk, I_L = 54 Apk, L = 0.44 mH, R_G = 25 Ω)	E_{AS}	640	mJ
Thermal Resistance — Junction to Case — Junction to Ambient	$R_{\theta JC}$ $R_{\theta JA}$	0.7 80	°C/W
Maximum Lead Temperature for Soldering Purposes, 1/8″ from case for 5 seconds	T_L	260	°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.

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

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Drain-Source Breakdown Voltage (V_{GS} = 0 V, I_D = 250 µAdc)	BV_{DSS}	50	—	—	Vdc
Temperature Coefficient (Positive)		—	—	—	mV/°C
Zero Gate Voltage Drain Current (V_{DS} = 50 Vdc, V_{GS} = 0)	I_{DSS}	—	—	10	µAdc
(V_{DS} = 40 Vdc, V_{GS} = 0, T_J = 125°C)		—	—	100	
Gate-Body Leakage Current (V_{GS} = ±20 Vdc, V_{DS} = 0)	I_{GSS}	—	—	100	nAdc
ON CHARACTERISTICS*					
Gate Threshold Voltage (V_{DS} = V_{GS}, I_D = 250 µAdc)	$V_{GS(th)}$	2.0	3.0	4.0	Vdc
Temperature Coefficient (Negative) (T_J = 125°C)		1.5	—	3.5	mV/°C
Static Drain-Source On-Resistance (V_{GS} = 10 Vdc, I_D = 27 Adc)	$R_{DS(on)}$	—	—	0.014	Ohm
Drain-Source On-Voltage (V_{GS} = 10 Vdc) (I_D = 54 Adc)	$V_{DS(on)}$	—	—	1.0	Vdc
(I_D = 27 Adc, T_J = 125°C)		—	—	0.8	
Forward Transconductance (V_{DS} = 10 Vdc, I_D = 27 Adc)	g_{FS}	31	—	—	mhos
DYNAMIC CHARACTERISTICS					
Input Capacitance	C_{iss}	—	4500	6300	pF
Output Capacitance (V_{DS} = 25 Vdc, V_{GS} = 0, f = 1.0 MHz)	C_{oss}	—	2300	3200	
Reverse Transfer Capacitance	C_{rss}	—	750	1050	
SWITCHING CHARACTERISTICS*†					
Turn-On Delay Time	$t_{d(on)}$	—	30	60	ns
Rise Time (V_{DD} = 25 Vdc, I_D = 54 Adc, V_{GS} = 10 Vdc, R_g = 9.1 Ω)	t_r	—	280	560	
Turn-Off Delay Time	$t_{d(off)}$	—	165	330	
Fall Time	t_f	—	270	550	
Gate Charge	Q_g	—	150	190	nC
Gate-Source Charge (V_{DS} = 40 Vdc, I_D = 54 Adc, V_{GS} = 10 Vdc)	Q_{gs}	—	40	—	
Gate-Drain Charge	Q_{gd}	—	65	—	
SOURCE-DRAIN DIODE CHARACTERISTICS*					
Forward On-Voltage (I_S = 54 Adc, V_{GS} = 0)	V_{SD}	—	—	—	Vdc
(I_S = 6.0 Adc, V_{GS} = 0, T_J = 125°C)		—	0.6	1.2	
Reverse Recovery Time (I_S = 54 Adc, V_{GS} = 0, dI_S/dt = 100 A/µs)	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 ≤ 300 µs, Duty Cycle ≤ 2%

†Switching characteristics are independent of operating junction temperature