

Designer's Data Sheet
Power Field Effect Transistor
N-Channel Enhancement-Mode
Silicon Gate TMOS

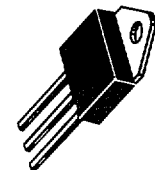
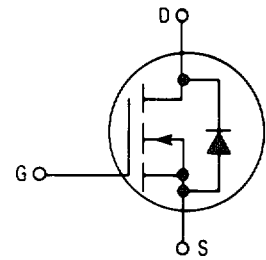
These TMOS Power FETs are designed for high voltage, high speed power switching applications such as switching regulators, converters, solenoid and relay drivers.

- Silicon Gate for Fast Switching Speeds — Switching Times Specified at 100°C
- Designer's Data — I_{DSS} , $V_{DS(on)}$, $V_{GS(th)}$ and SOA Specified at Elevated Temperature
- SOA is Power Dissipation Limited
- Source-to-Drain Diode Characterized for Use With Inductive Loads
- Similar To IRFPG50



MTH6N100

TMOS POWER FETs
 6 AMPERES
 $r_{DS(on)} = 2$ OHMS
 1000 VOLTS



CASE 340-02
 TO-218AC

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

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	1000	Vdc
Drain-Gate Voltage ($R_{GS} = 1 \text{ M}\Omega$)	V_{DGR}	1000	Vdc
Gate-Source Voltage — Continuous	V_{GS}	± 20	Vdc
— Non-Repetitive ($t_p \leq 50 \mu\text{s}$)	V_{GSM}	± 40	
Drain Current — Continuous	I_D	6	Adc
— Pulsed	I_{DM}	24	
Total Power Dissipation Derate above 25°C	P_D	180 1.44	Watts W/°C
Operating and Storage Temperature Range	T_J, T_{stg}	-65 to 150	°C

THERMAL CHARACTERISTICS

Thermal Resistance — Junction to Case	$R_{\theta JC}$	0.7	°C/W
— Junction to Ambient	$R_{\theta JA}$	30	
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds	T_L	275	°C

TMOS and Designer's are trademarks of Motorola Inc.

Designer's Data for "Worst Case" Conditions — The Designer's Data Sheet permits the design of most circuits entirely from the information presented. SOA Limit curves — representing boundaries on device characteristics — are given to facilitate "worst case" design.




MOTOROLA

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

Characteristic	Symbol	Min	Max	Unit	
OFF CHARACTERISTICS					
Drain-Source Breakdown Voltage ($V_{GS} = 0, I_D = 250 \mu\text{A}$)	$V_{(BR)DSS}$	1000	—	Vdc	
Zero Gate Voltage Drain Current ($V_{DS} = 1000 \text{ Vdc}, V_{GS} = 0$) ($V_{DS} = 1000 \text{ Vdc}, V_{GS} = 0, T_J = 125^\circ\text{C}$)	I_{DSS}	—	250 1000	μAdc	
Gate-Body Leakage Current, Forward ($V_{GSF} = 20 \text{ Vdc}, V_{DS} = 0$)	I_{GSSF}	—	100	nAdc	
Gate-Body Leakage Current, Reverse ($V_{GSR} = 20 \text{ Vdc}, V_{DS} = 0$)	I_{GSSR}	—	100	nAdc	
ON CHARACTERISTICS*					
Gate Threshold Voltage ($V_{DS} = V_{GS}, I_D = 250 \mu\text{A}$) $T_J = 100^\circ\text{C}$	$V_{GS(th)}$	2 1.5	4 3.5	Vdc	
Static Drain-Source On-Resistance ($V_{GS} = 10 \text{ Vdc}, I_D = 3 \text{ Adc}$)	$r_{DS(on)}$	—	2	Ohms	
Drain-Source On-Voltage ($V_{GS} = 10 \text{ V}$) ($I_D = 6 \text{ Adc}$) ($I_D = 3 \text{ Adc}, T_J = 100^\circ\text{C}$)	$V_{DS(on)}$	—	15 12	Vdc	
Forward Transconductance ($V_{DS} = 20 \text{ V}, I_D = 3 \text{ A}$)	g_{FS}	4	—	mhos	
DYNAMIC CHARACTERISTICS					
Input Capacitance	($V_{DS} = 25 \text{ V}, V_{GS} = 0,$ $f = 1 \text{ MHz}$) See Figure 10	C_{iss}	2000 (Typ)	—	pF
Output Capacitance		C_{oss}	175 (Typ)	—	
Reverse Transfer Capacitance		C_{rss}	100 (Typ)	—	
SWITCHING CHARACTERISTICS* ($T_J = 100^\circ\text{C}$)					
Turn-On Delay Time	($V_{DD} = 25 \text{ V}, I_D = 3 \text{ Amps}$ $R_{gen} = 50 \text{ ohms}$) See Figures 13 and 14	$t_{d(on)}$	55 (Typ)	—	ns
Rise Time		t_r	175 (Typ)	—	
Turn-Off Delay Time		$t_{d(off)}$	440 (Typ)	—	
Fall Time		t_f	180 (Typ)	—	
Total Gate Charge	($V_{DS} = 800 \text{ V},$ $I_D = 6 \text{ Amps}, V_{GS} = 10 \text{ V}$) See Figures 11 and 12	Q_g	110 (Typ)	140	nC
Gate-Source Charge		Q_{gs}	60 (Typ)	—	
Gate-Drain Charge		Q_{gd}	50 (Typ)	—	
SOURCE DRAIN DIODE CHARACTERISTICS*					
Forward On-Voltage	($I_S = 6 \text{ Amps}, V_{GS} = 0$)	V_{SD}	1.1 (Typ)	1.5	Vdc
Forward Turn-On Time	($I_S = 6 \text{ A}, dI_S/dt = 100 \text{ A}/\mu\text{s},$ $V_R = 70 \text{ V}$) See Figures 15 and 16	t_{on}	Limited by stray inductance		
Reverse Recovery Time		t_{rr}	1200 (Typ)	—	ns
INTERNAL PACKAGE INDUCTANCE (TO-218)					
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	4 (Typ) 5 (Typ)	—	—	nH
Internal Source Inductance (Measured from the source lead 0.25" from package to source bond pad.)	L_s	10 (Typ)	—	—	

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

Motorola reserves the right to make changes without further notice to any products herein to improve reliability, function or design. Motorola does not assume any liability arising out of the application or use of any product or circuit described herein; neither does it convey any license under its patent rights nor the rights of others. Motorola products are not authorized for use as components in life support devices or systems intended for surgical implant into the body or intended to support or sustain life. Buyer agrees to notify Motorola of any such intended end use whereupon Motorola shall determine availability and suitability of its product or products for the use intended. Motorola and  are registered trademarks of Motorola, Inc. Motorola, Inc. is an Equal Employment Opportunity/Affirmative Action Employer.

TYPICAL ELECTRICAL CHARACTERISTICS

Figure 1. On-Region Characteristics

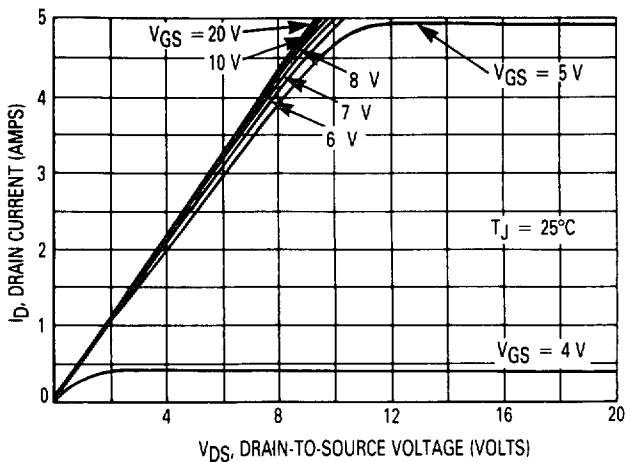


Figure 2. Gate-Threshold Voltage Variation With Temperature

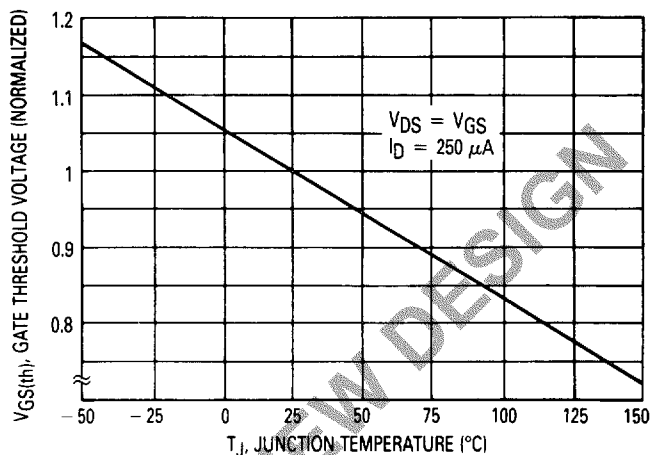


Figure 3. Transfer Characteristics

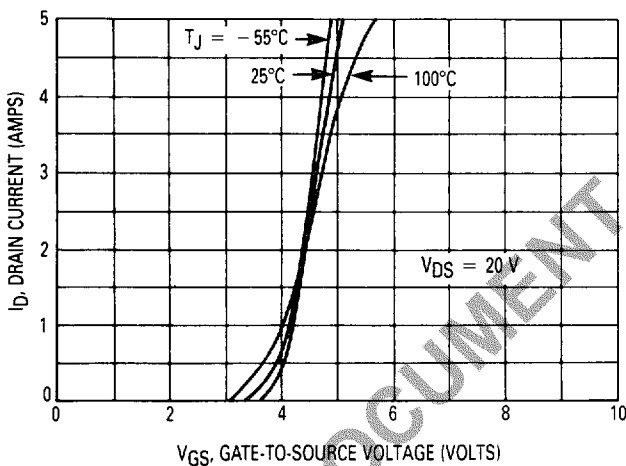


Figure 4. Breakdown Voltage Variation With Temperature

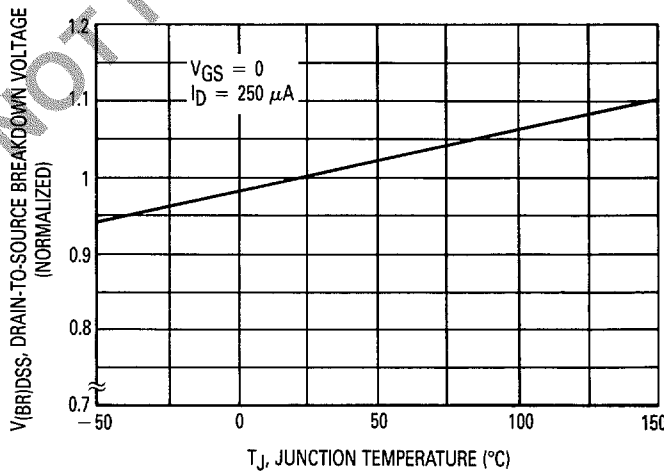


Figure 5. On-Resistance versus Drain Current

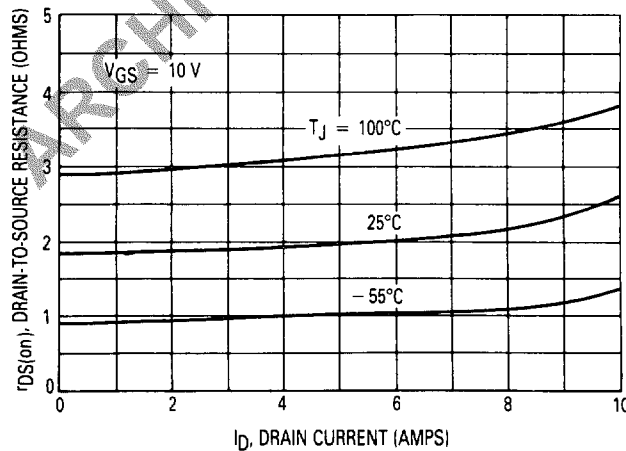
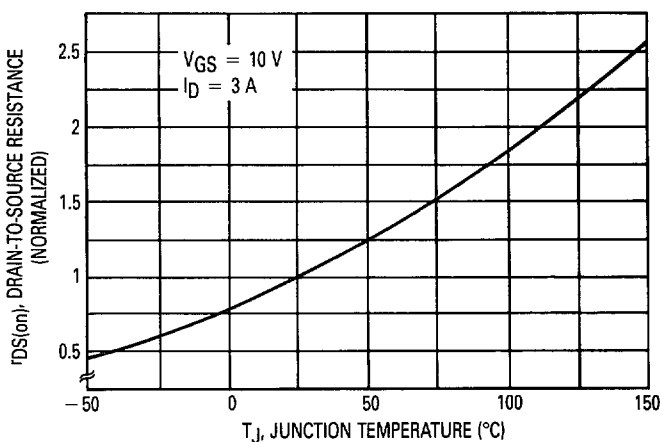


Figure 6. On-Resistance Variation With Temperature



SAFE OPERATING AREA INFORMATION

Figure 7. Maximum Rated Forward Biased Safe Operating Area

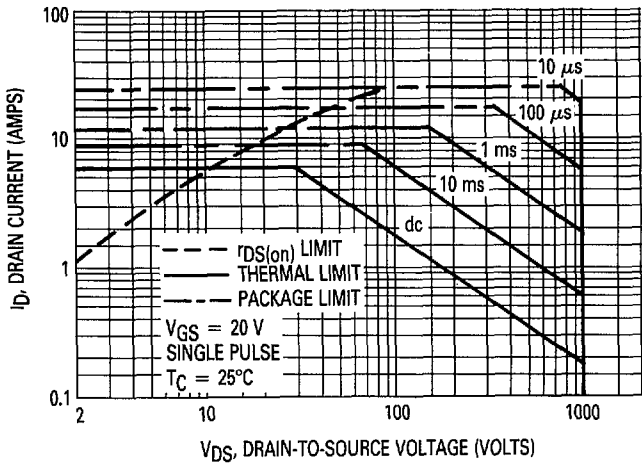
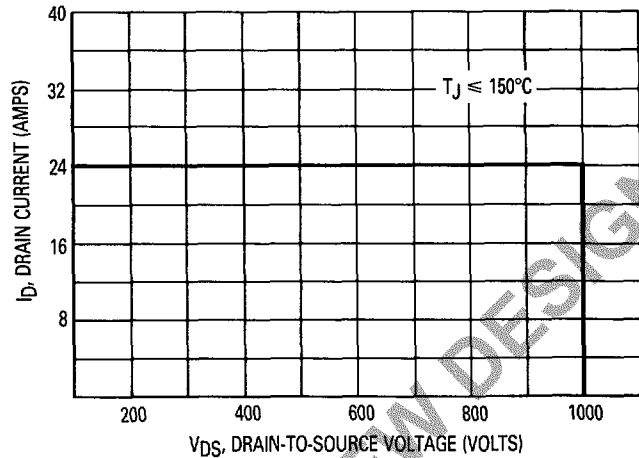


Figure 8. Maximum Rated Switching Safe Operating Area



FORWARD BIASED SAFE OPERATING AREA

The FBSOA curves define the maximum drain-to-source voltage and drain current that a device can safely handle when it is forward biased, or when it is on, or being turned on. Because these curves include the limitations of simultaneous high voltage and high current, up to the rating of the device, they are especially useful to designers of linear systems. The curves are based on a case temperature of 25°C and a maximum junction temperature of 150°C. Limitations for repetitive pulses at various case temperatures can be determined by using the thermal response curves. Motorola Application Note, AN569, "Transient Thermal Resistance-General Data and Its Use" provides detailed instructions.

SWITCHING SAFE OPERATING AREA

The switching safe operating area (SOA) of Figure 8 is the boundary that the load line may traverse without incurring damage to the MOSFET. The fundamental limits are the peak current, I_{DM} and the breakdown voltage, $V_{(BR)DSS}$. The switching SOA shown in Figure 8 is applicable for both turn-on and turn-off of the devices for switching times less than one microsecond.

The power averaged over a complete switching cycle must be less than:

$$\frac{T_{J(max)} - T_C}{R_{\theta JC}}$$

Figure 9. Thermal Response

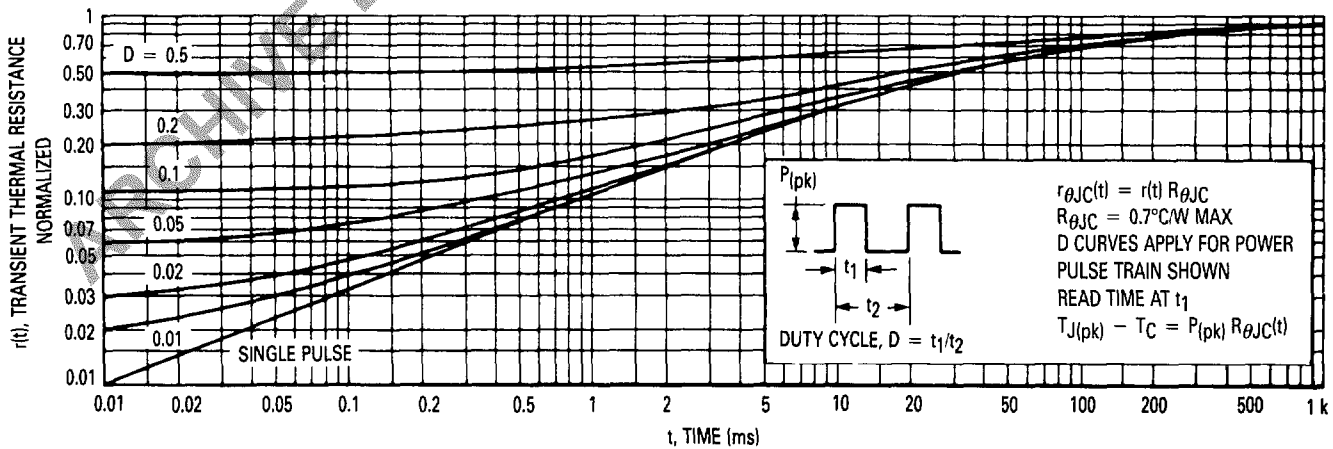


Figure 10. Capacitance Variation

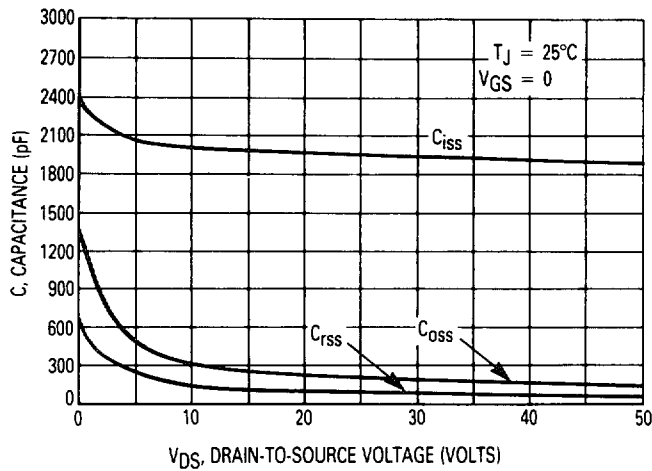
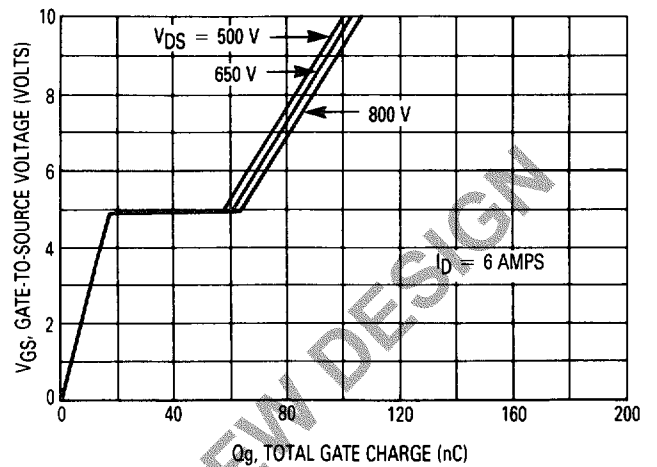


Figure 11. Gate Charge versus Gate-to-Source Voltage



RESISTIVE SWITCHING

Figure 12. Gate Charge Test Circuit

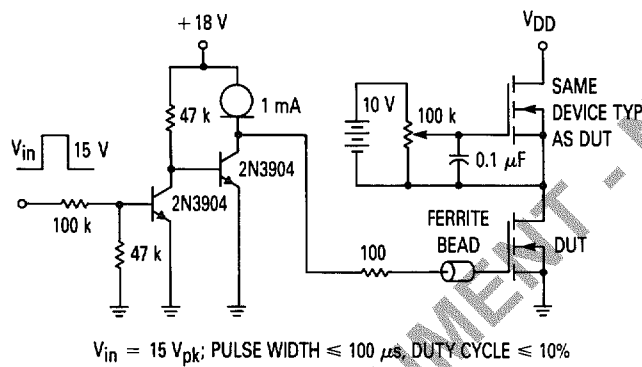


Figure 13. Switching Test Circuit

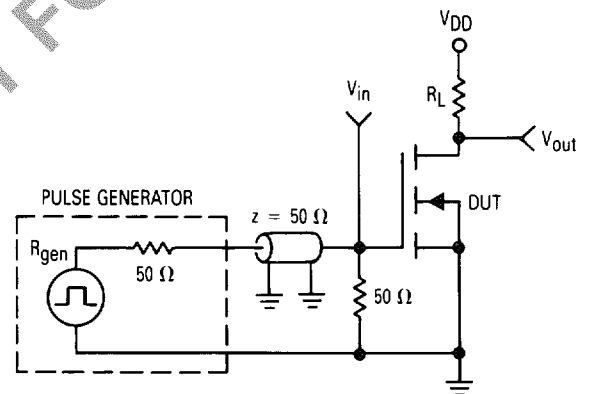


Figure 14. Switching Waveforms

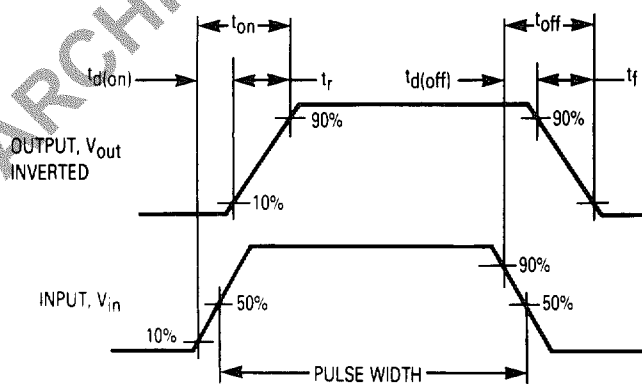


Figure 15. Diode Switching Waveform

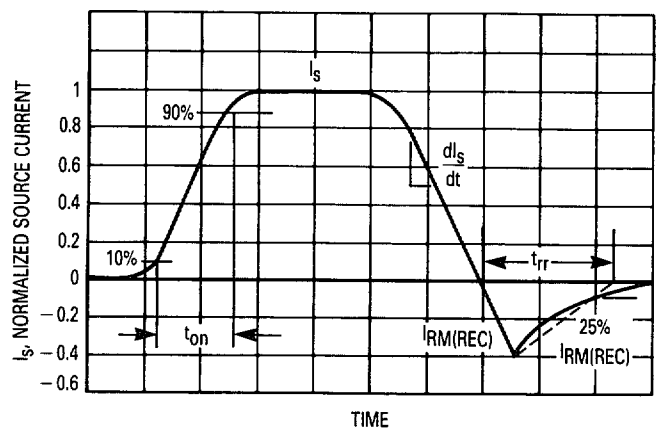
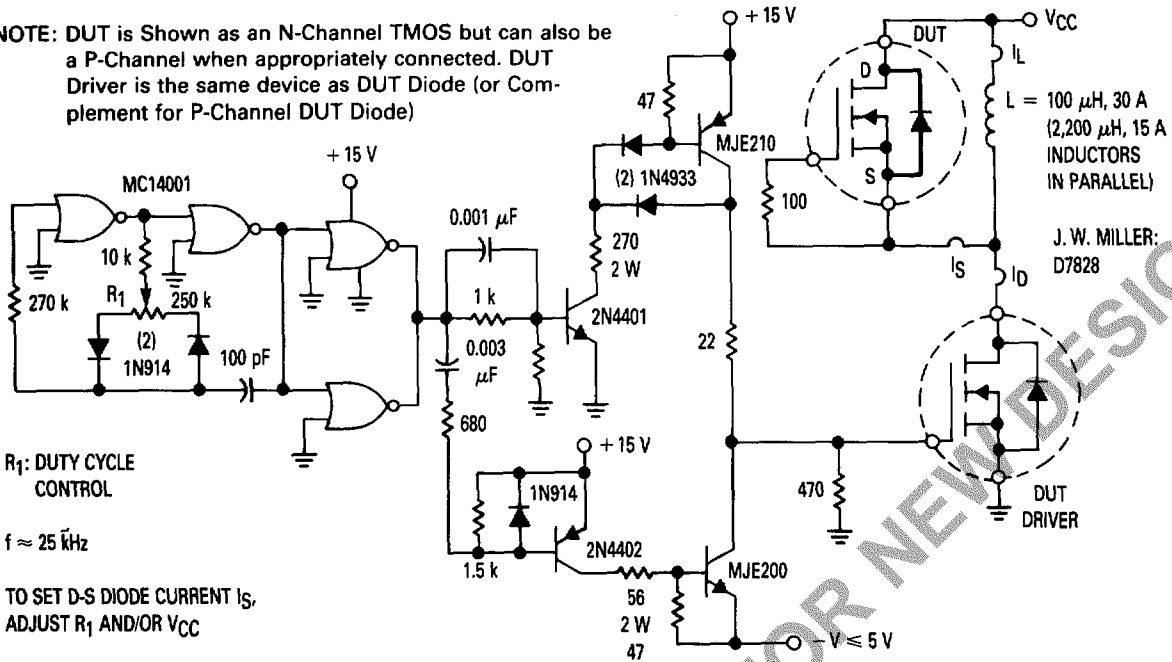


Figure 16. TMOS Diode Switching Test Circuit

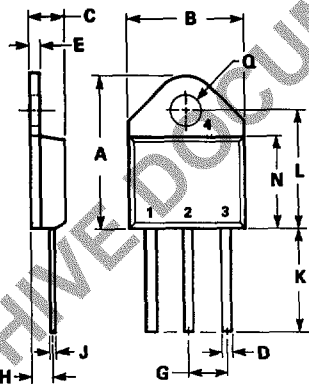
NOTE: DUT is Shown as an N-Channel TMOS but can also be a P-Channel when appropriately connected. DUT Driver is the same device as DUT Diode (or Complement for P-Channel DUT Diode)



OUTLINE DIMENSIONS

CASE 340-02
TO-218AC

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.



STYLE 2:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	20.32	21.08	0.800	0.830
B	15.49	15.90	0.610	0.626
C	4.19	5.08	0.165	0.200
D	1.02	1.65	0.040	0.065
E	1.35	1.65	0.053	0.065
G	5.21	5.72	0.205	0.225
H	2.65	2.94	0.104	0.116
J	0.38	0.64	0.015	0.025
K	12.70	15.49	0.500	0.610
L	15.88	16.51	0.625	0.650
N	12.19	12.70	0.480	0.500
Q	4.04	4.22	0.159	0.166

Literature Distribution Centers:

USA: Motorola Literature Distribution; P.O. Box 20912; Phoenix, Arizona 85036.
EUROPE: Motorola Ltd.; European Literature Center; 88 Tanners Drive, Blakelands Milton Keynes, MK145BP, England.
ASIA PACIFIC: Motorola Semiconductors H.K. Ltd.; P.O. Box 80300; Cheung Sha Wan Post Office; Kowloon Hong Kong.



MOTOROLA