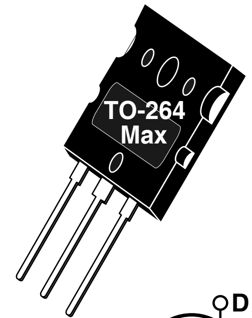
Microsemi
POWER PRODUCTS GROUP

APT94N60L2C3

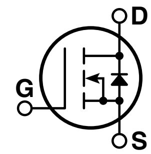
600V 94A 0.035Ω

Super Junction MOSFET



COOLMOS Power Semiconductors

- **Ultra low $R_{DS(ON)}$**
- **Low Miller Capacitance**
- **Ultra Low Gate Charge, Q_g**
- **Avalanche Energy Rated**
- **TO-264 Max Package**



Unless stated otherwise, Microsemi discrete MOSFETs contain a single MOSFET die. This device is made with two parallel MOSFET die. It is intended for switch-mode operation. It is not suitable for linear mode operation.

MAXIMUM RATINGS All Ratings: T_C = 25°C unless otherwise specified.

Symbol	Parameter	APT94N60L2C3	UNIT
V_{DSS}	Drain-Source Voltage	600	Volts
I_D	Continuous Drain Current @ T_C = 25°C	94	Amps
I_{DM}	Pulsed Drain Current ①	282	Amps
V_{GS}	Gate-Source Voltage Continuous	±20	Volts
V_{GSM}	Gate-Source Voltage Transient	±30	Volts
P_D	Total Power Dissipation @ T_C = 25°C	833	Watts
	Linear Derating Factor	6.67	W/°C
T_J,T_{STG}	Operating and Storage Junction Temperature Range	-55 to 150	°C
T_L	Lead Temperature: 0.063" from Case for 10 Sec.	300	°C
$^{dv}/_{dt}$	Drain-Source Voltage slope (V_{DS} = 480V, I_D = 94A, T_J = 125°C)	50	V/ns
I_{AR}	Repetitive Avalanche Current ⑦	20	Amps
E_{AR}	Repetitive Avalanche Energy ⑦	1	mJ
E_{AS}	Single Pulse Avalanche Energy ④	1800	mJ

STATIC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
BV_{DSS}	Drain-Source Breakdown Voltage (V_{GS} = 0V, I_D = 500μA)	600			Volts
$R_{DS(on)}$	Drain-Source On-State Resistance ② (V_{GS} = 10V, 60A)		0.03	0.035	Ohms
I_{DSS}	Zero Gate Voltage Drain Current (V_{DS} = 600V, V_{GS} = 0V)		1.0	50	μA
	Zero Gate Voltage Drain Current (V_{DS} = 600V, V_{GS} = 0V, T_J = 150°C)			500	μA
I_{GSS}	Gate-Source Leakage Current (V_{GS} = ±20V, V_{DS} = 0V)			±200	nA
$V_{GS(th)}$	Gate Threshold Voltage (V_{DS} = V_{GS}, I_D = 5.4mA)	2.10	3	3.9	Volts

CAUTION: These Devices are Sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed.

Microsemi Website - http://www.microsemi.com

DYNAMIC CHARACTERISTICS

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
C_{iss}	Input Capacitance	V_{GS} = 0V, V_{DS} = 25V, f = 1 MHz		13600		pF
C_{oss}	Output Capacitance			4400		
C_{rss}	Reverse Transfer Capacitance			290		
Q_g	Total Gate Charge ③	V_{GS} = 10V, V_{DD} = 300V, I_D = 94A @ 25°C		505	640	nC
Q_{gs}	Gate-Source Charge			48		
Q_{gd}	Gate-Drain ("Miller") Charge			240		
$t_{d(on)}$	Turn-on Delay Time	**RESISTIVE SWITCHING** V_{GS} = 13V, V_{DD} = 380V, I_D = 94A @ 125°C, R_G = 0.9Ω		18		ns
t_r	Rise Time			27		
$t_{d(off)}$	Turn-off Delay Time			110	165	
t_f	Fall Time			8	12	
E_{on}	Turn-on Switching Energy ⑥	**INDUCTIVE SWITCHING @ 25°C** V_{DD} = 400V, V_{GS} = 15V, I_D = 94A, R_G = 5Ω		2040		μJ
E_{off}	Turn-off Switching Energy			3515		
E_{on}	Turn-on Switching Energy ⑥	**INDUCTIVE SWITCHING @ 125°C** V_{DD} = 400V V_{GS} = 15V, I_D = 94A, R_G = 5Ω		2920		
E_{off}	Turn-off Switching Energy			3970		

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
I_S	Continuous Source Current (Body Diode)			94	Amps
I_{SM}	Pulsed Source Current ① (Body Diode)			282	
V_{SD}	Diode Forward Voltage ② (V_{GS} = 0V, I_S = -94A)		1	1.2	Volts
t_{rr}	Reverse Recovery Time (I_S = -94A, dI_S/dt = 100A/μs, V_R = 350V)		861		ns
Q_{rr}	Reverse Recovery Charge (I_S = -94A, dI_S/dt = 100A/μs, V_R = 350V)		46		μC
dv/dt	Peak Diode Recovery dv/dt ⑤			6	V/ns

THERMAL CHARACTERISTICS

Symbol	Characteristic	MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction to Case			0.15	°C/W
$R_{\theta JA}$	Junction to Ambient			62	

① Repetitive Rating: Pulse width limited by maximum junction temperature

② Pulse Test: Pulse width < 380 μs, Duty Cycle < 2%

③ See MIL-STD-750 Method 3471

④ Starting T_j = +25°C, L = 36.0mH, R_G = 25Ω, Peak I_L = 10A

⑤ dv/dt numbers reflect the limitations of the test circuit rather than the device itself. $I_S \leq -I_D$94A $di/dt \leq$ 700A/μs $V_R \leq V_{DSS}$ $T_J \leq$ 150°C

⑥ Eon includes diode reverse recovery. See figures 18, 20.

⑦ Repetitve avalanche causes additional power losses that can be calculated as $P_{AV} = E_{AR} * f$

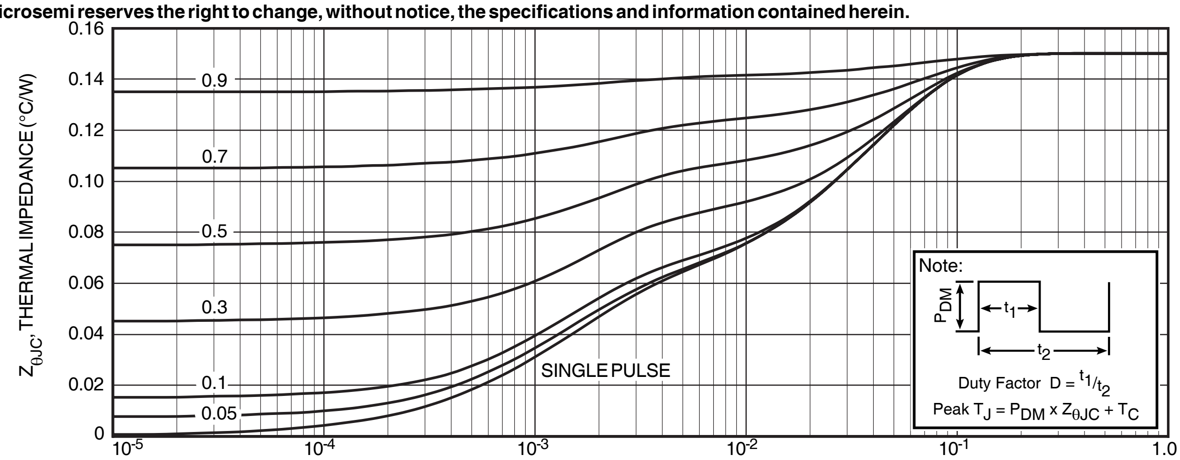


FIGURE 1, MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs PULSE DURATION

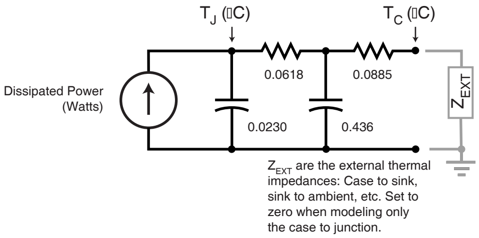


FIGURE 2, TRANSIENT THERMAL IMPEDANCE MODEL

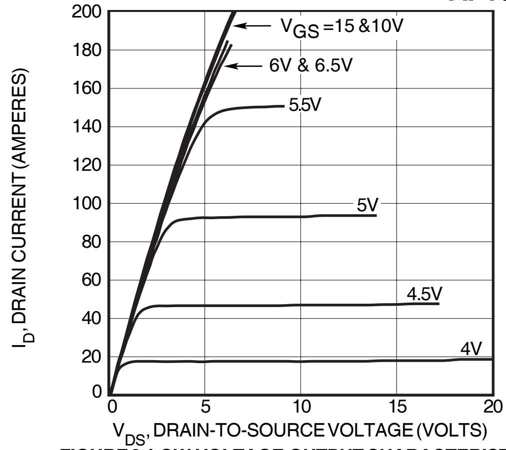


FIGURE 3, LOW VOLTAGE OUTPUT CHARACTERISTICS

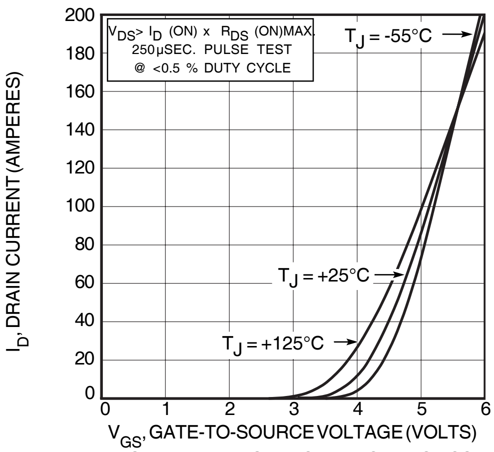


FIGURE 4, TRANSFER CHARACTERISTICS

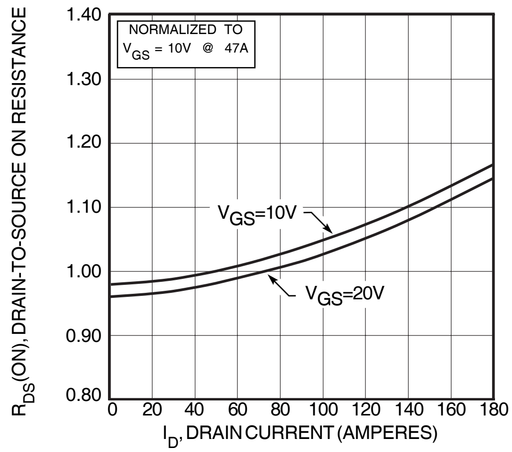


FIGURE 5, R_{DS}(ON) vs DRAIN CURRENT

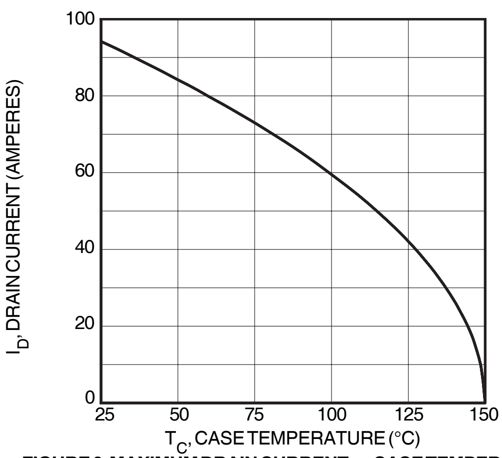


FIGURE 6, MAXIMUM DRAIN CURRENT vs CASE TEMPERATURE

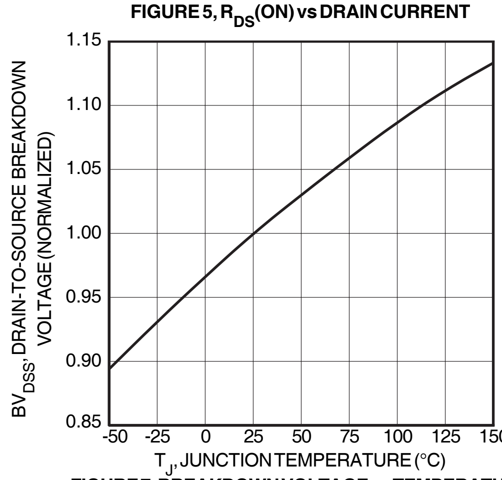


FIGURE 7, BREAKDOWN VOLTAGE vs TEMPERATURE

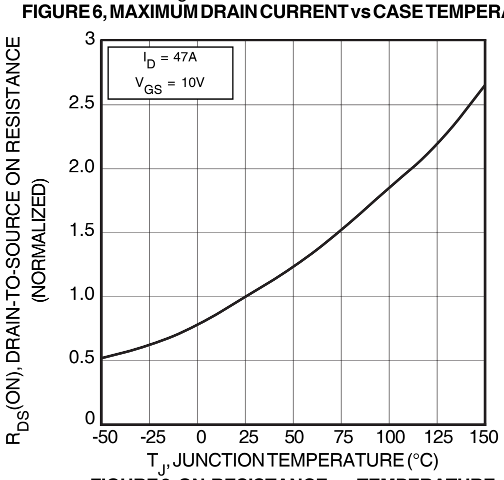


FIGURE 8, ON-RESISTANCE vs. TEMPERATURE

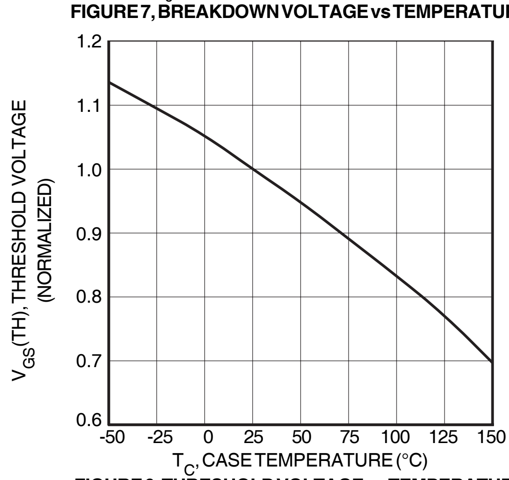


FIGURE 9, THRESHOLD VOLTAGE vs TEMPERATURE

I_D, DRAIN CURRENT (AMPERES)

Graph removed

V_{DS}, DRAIN-TO-SOURCE VOLTAGE (VOLTS)

FIGURE 10, MAXIMUM SAFE OPERATING AREA

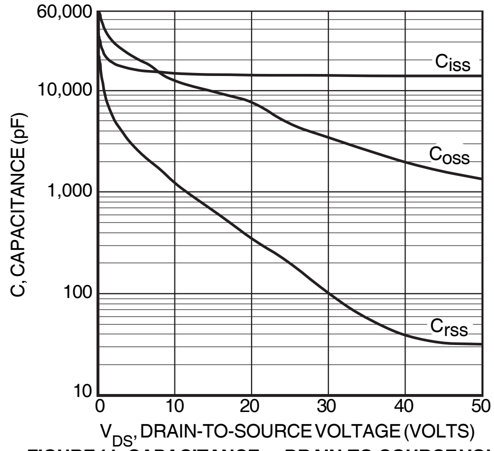


FIGURE 11, CAPACITANCE vs DRAIN-TO-SOURCE VOLTAGE

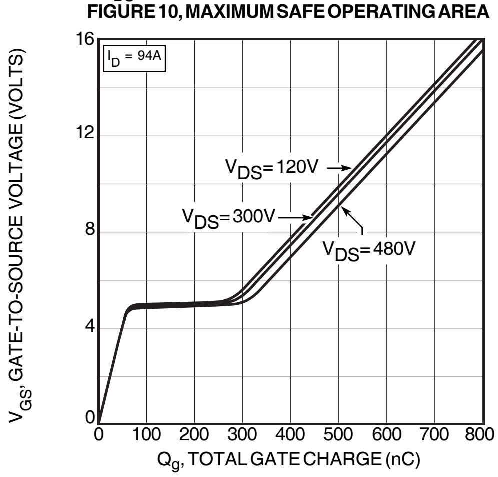


FIGURE 12, GATE CHARGES vs GATE-TO-SOURCE VOLTAGE

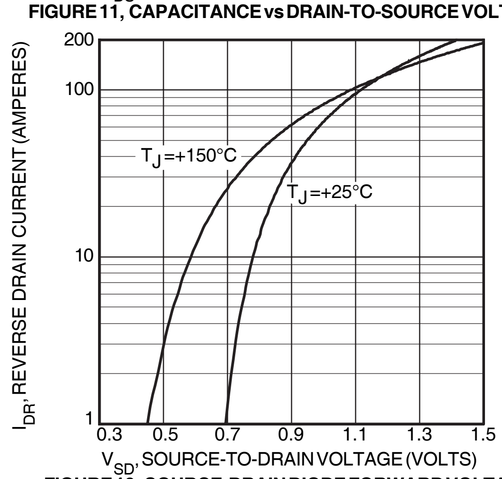


FIGURE 13, SOURCE-DRAIN DIODE FORWARD VOLTAGE

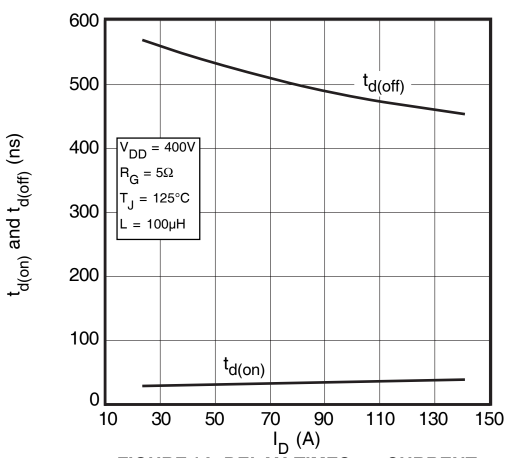


FIGURE 14, DELAY TIMES vs CURRENT

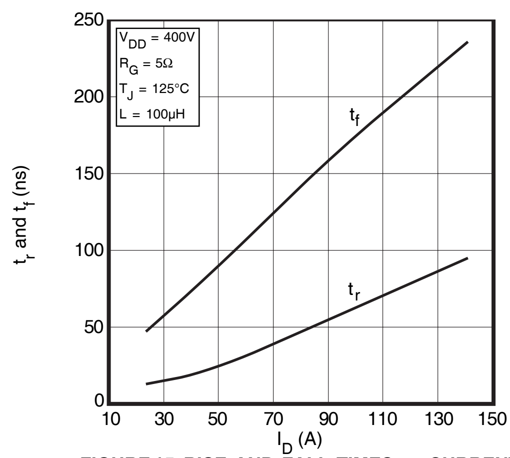


FIGURE 15, RISE AND FALL TIMES vs CURRENT

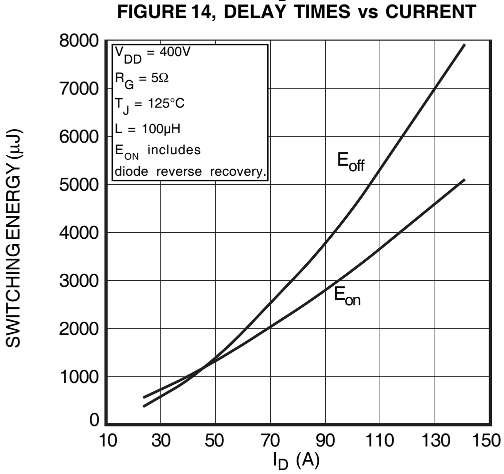


FIGURE 16, SWITCHING ENERGY vs CURRENT

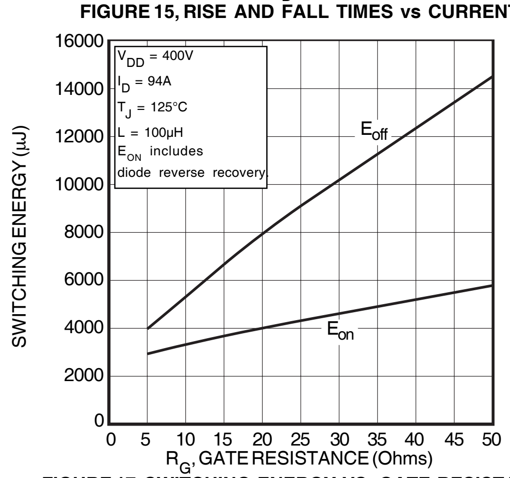


FIGURE 17, SWITCHING ENERGY VS. GATE RESISTANCE

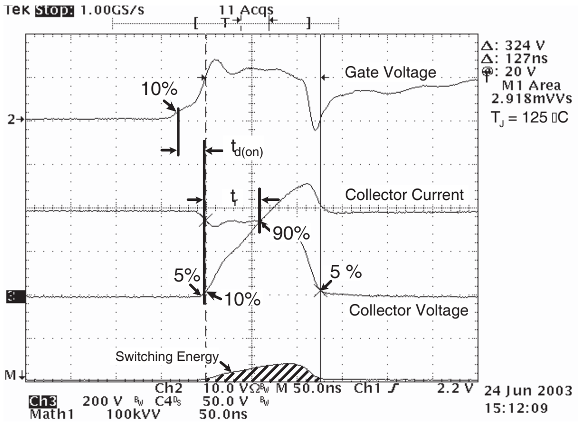


Figure 18, Turn-on Switching Waveforms and Definitions

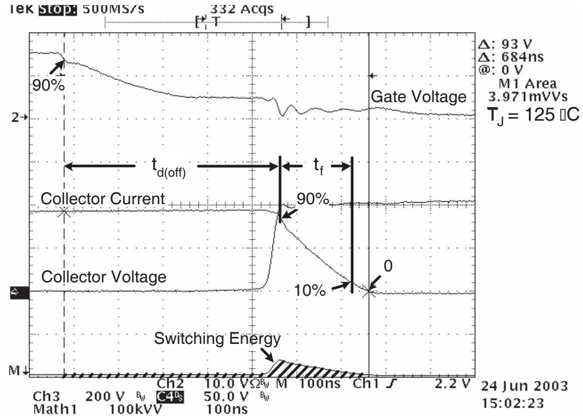


Figure 19, Turn-off Switching Waveforms and Definitions

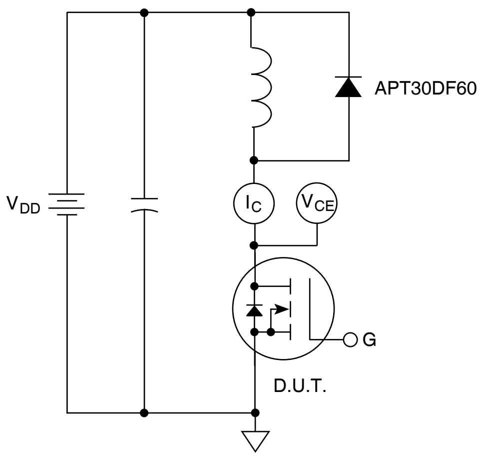
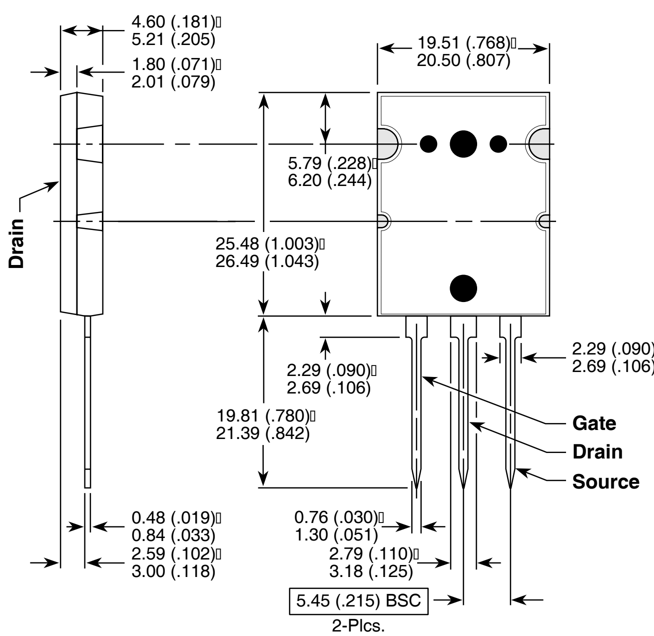


Figure 20, Inductive Switching Test Circuit

TO-264 MAX™(L2) Package Outline



Dimensions in Millimeters and (Inches)