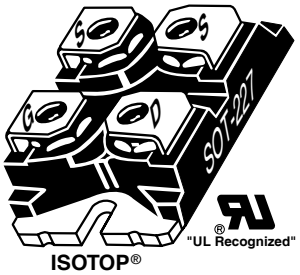
ADVANCED POWER TECHNOLOGY®

APT31N80JC3

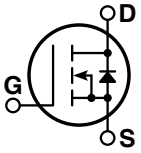
800V 31A 0.145Ω

Super Junction MOSFET



COOLMOS™ Power Semiconductors

- Ultra low $R_{DS(ON)}$
- Low Miller Capacitance
- Ultra Low Gate Charge, Q_g
- Avalanche Energy Rated
- N-Channel Enhancement Mode
- Popular SOT-227 Package



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

Symbol	Parameter	APT31N80JC3	UNIT
V_{DSS}	Drain-Source Voltage	800	Volts
I_D	Continuous Drain Current @ T_C = 25°C	31	Amps
I_{DM}	Pulsed Drain Current ①	93	
V_{GS}	Gate-Source Voltage Continuous	±20	Volts
V_{GSM}	Gate-Source Voltage Transient	±30	
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	
dv/dt	Drain-Source Voltage slope (V_{DS} = 640V, I_D = 31A, T_J = 125°C)	50	V/ns
I_{AR}	Repetitive Avalanche Current ⑦	17	Amps
E_{AR}	Repetitive Avalanche Energy ⑦	0.5	mJ
E_{AS}	Single Pulse Avalanche Energy ④	670	

STATIC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
BV_{DSS}	Drain-Source Breakdown Voltage (V_{GS} = 0V, I_D = 500µA)	800			Volts
$R_{DS(on)}$	Drain-Source On-State Resistance ② (V_{GS} = 10V, I_D = 22A)		0.125	0.145	Ohms
I_{DSS}	Zero Gate Voltage Drain Current (V_{DS} = 800V, V_{GS} = 0V)		0.5	25	µA
	Zero Gate Voltage Drain Current (V_{DS} = 800V, V_{GS} = 0V, T_J = 150°C)			250	
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 = 2mA)	2.10	3	3.9	Volts

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

APT Website - http://www.advancedpower.com

"COOLMOS™ comprise a new family of transistors developed by Infineon Technologies AG. "COOLMOS" is a trademark of Infineon Technologies AG"

050-7143 Rev D 6-2004

DYNAMIC CHARACTERISTICS

APT31N80JC3

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
C_{iss}	Input Capacitance	V_{GS} = 0V V_{DS} = 25V f = 1 MHz		4510		pF
C_{oss}	Output Capacitance			2050		
C_{rss}	Reverse Transfer Capacitance			110		
Q_g	Total Gate Charge ③	V_{GS} = 10V V_{DD} = 400V I_D = 31A @ 25°C		180	355	nC
Q_{gs}	Gate-Source Charge			22		
Q_{gd}	Gate-Drain ("Miller") Charge			90		
$t_{d(on)}$	Turn-on Delay Time	**RESISTIVE SWITCHING** V_{GS} = 10V V_{DD} = 400V I_D = 31A @ 125°C R_G = 2.5Ω		25		ns
t_r	Rise Time			15		
$t_{d(off)}$	Turn-off Delay Time			70	80	
t_f	Fall Time			6	9	
E_{on}	Turn-on Switching Energy ⑥	**INDUCTIVE SWITCHING @ 25°C** V_{DD} = 533V, V_{GS} = 15V I_D = 31A, R_G = 5Ω		615		µJ
E_{off}	Turn-off Switching Energy			530		
E_{on}	Turn-on Switching Energy ⑥	**INDUCTIVE SWITCHING @ 125°C** V_{DD} = 533V, V_{GS} = 15V I_D = 31A, R_G = 5Ω		1025		
E_{off}	Turn-off Switching Energy			580		

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
I_S	Continuous Source Current (Body Diode)			31	Amps
I_{SM}	Pulsed Source Current ① (Body Diode)			93	
V_{SD}	Diode Forward Voltage ② (V_{GS} = 0V, I_S = -31A)		1	1.2	Volts
t_{rr}	Reverse Recovery Time (I_S = -31A, dI_S/dt = 100A/µs, V_R = 400V)		855		ns
Q_{rr}	Reverse Recovery Charge (I_S = -31A, dI_S/dt = 100A/µs, V_R = 400V)		30		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			0.37	°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 = 115.92mH, R_G = 25Ω, Peak I_L = 3.4A

⑤ I_S = -31A di/dt = 100A/µs V_R = 480V T_J = 125°C

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

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

APT Reserves the right to change, without notice, the specifications and information contained herein.

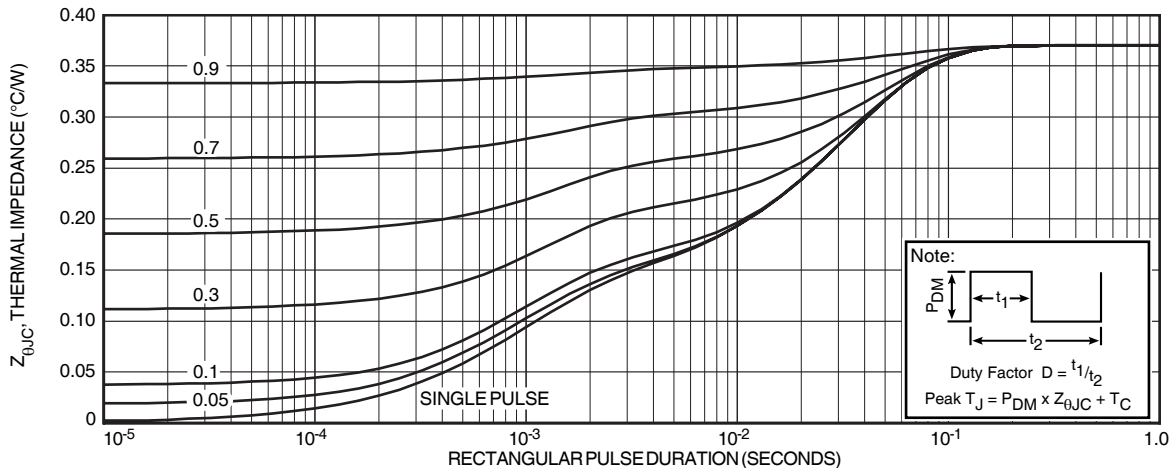


FIGURE 1, MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs PULSE DURATION

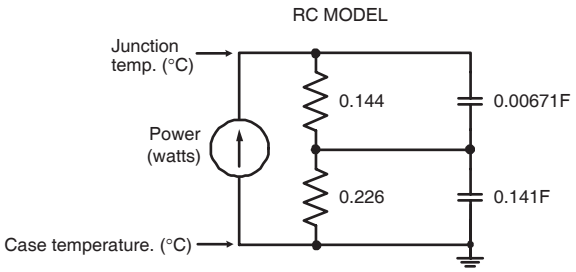


FIGURE 2, TRANSIENT THERMAL IMPEDANCE MODEL

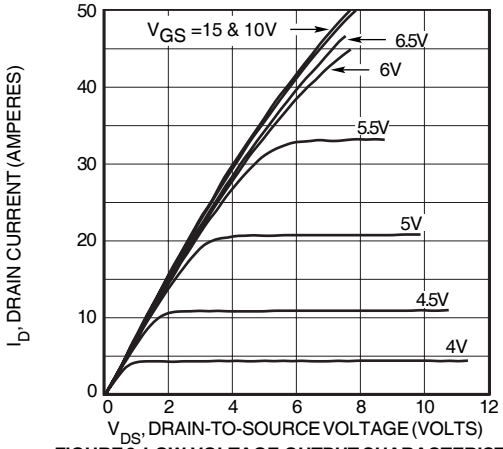


FIGURE 3, LOW VOLTAGE OUTPUT CHARACTERISTICS

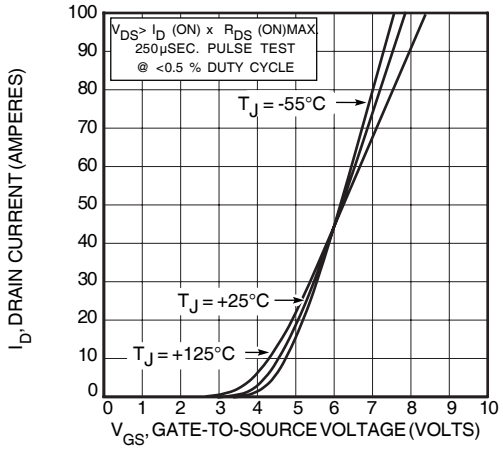


FIGURE 4, TRANSFER CHARACTERISTICS

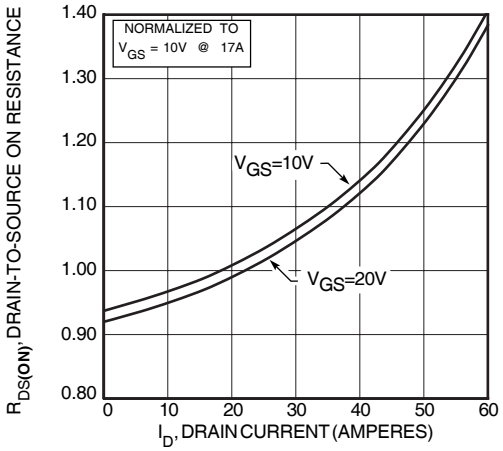


FIGURE 5, $R_{DS(ON)}$ vs DRAIN CURRENT

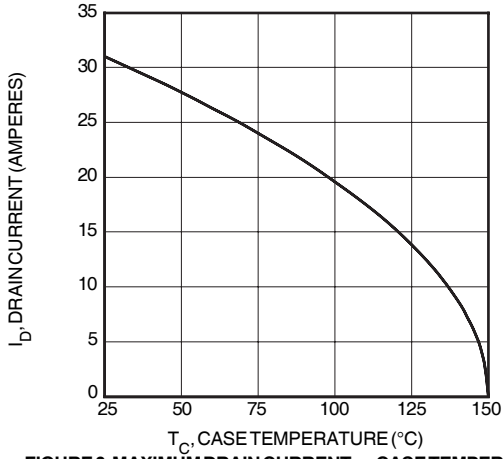


FIGURE 6, MAXIMUM DRAIN CURRENT vs CASE TEMPERATURE

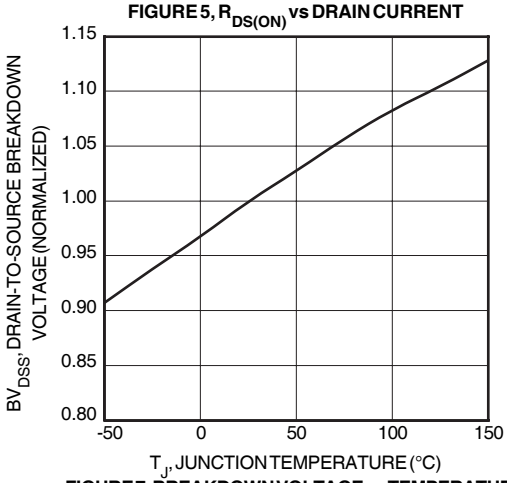


FIGURE 7, BREAKDOWN VOLTAGE vs TEMPERATURE

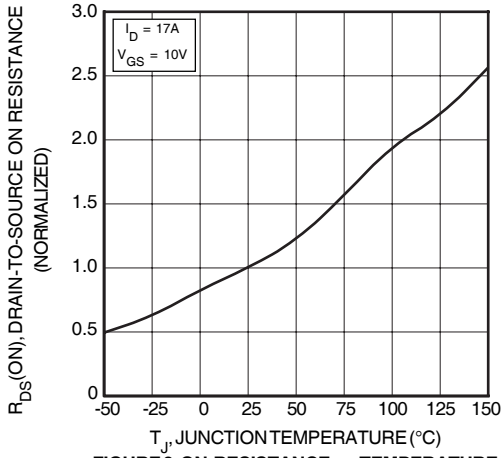


FIGURE 8, ON-RESISTANCE vs. TEMPERATURE

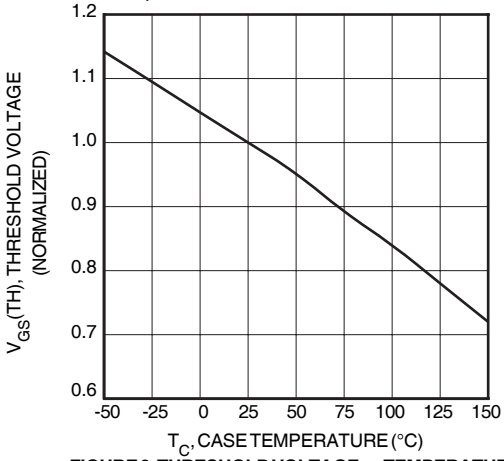


FIGURE 9, THRESHOLD VOLTAGE vs TEMPERATURE

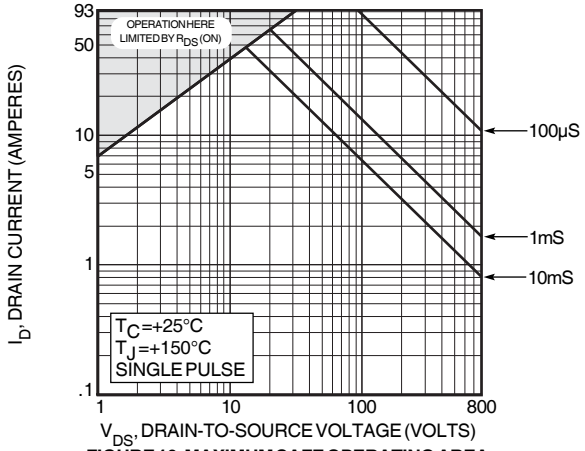


FIGURE 10, MAXIMUM SAFE OPERATING AREA

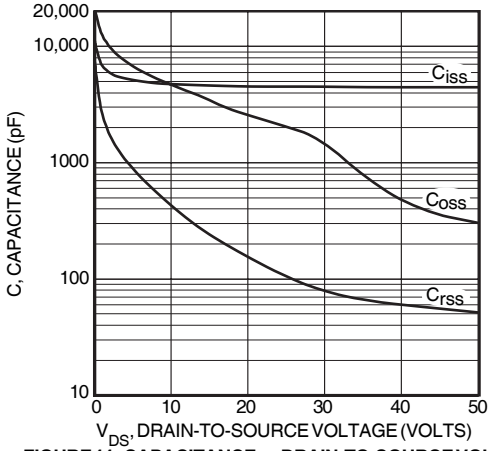


FIGURE 11, CAPACITANCE vs DRAIN-TO-SOURCE VOLTAGE

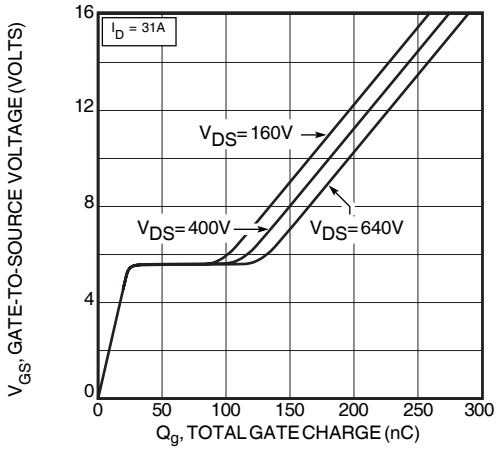


FIGURE 12, GATE CHARGES vs GATE-TO-SOURCE VOLTAGE

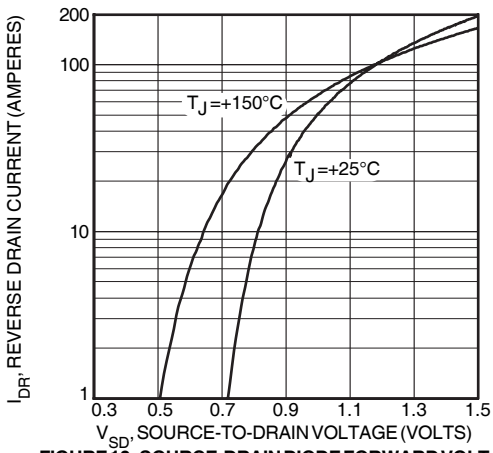


FIGURE 13, SOURCE-DRAIN DIODE FORWARD VOLTAGE

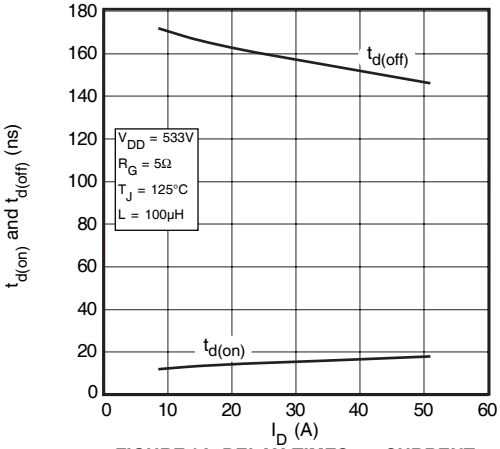


FIGURE 14, DELAY TIMES vs CURRENT

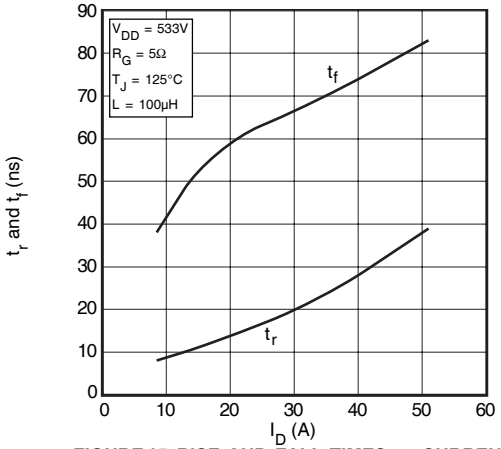


FIGURE 15, RISE AND FALL TIMES vs CURRENT

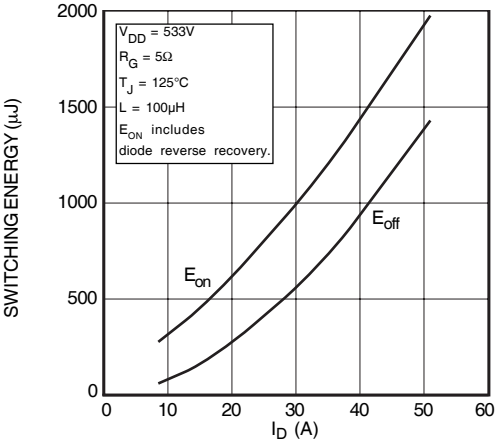


FIGURE 16, SWITCHING ENERGY vs CURRENT

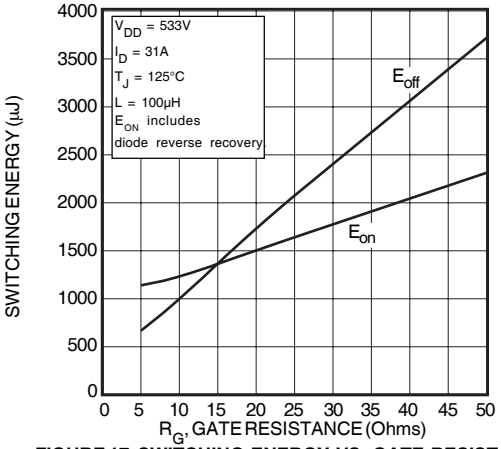


FIGURE 17, SWITCHING ENERGY VS. GATE RESISTANCE

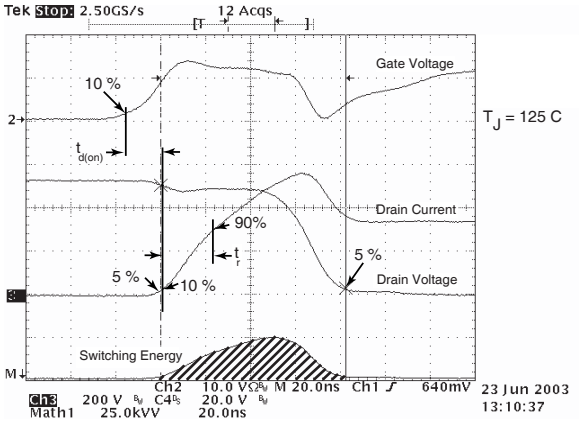


Figure 18, Turn-on Switching Waveforms and Definitions

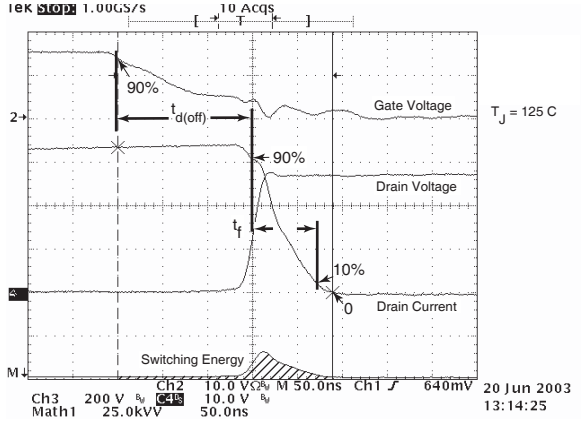


Figure 19, Turn-off Switching Waveforms and Definitions

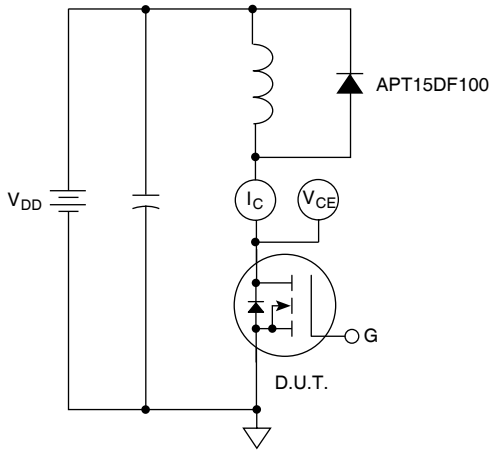
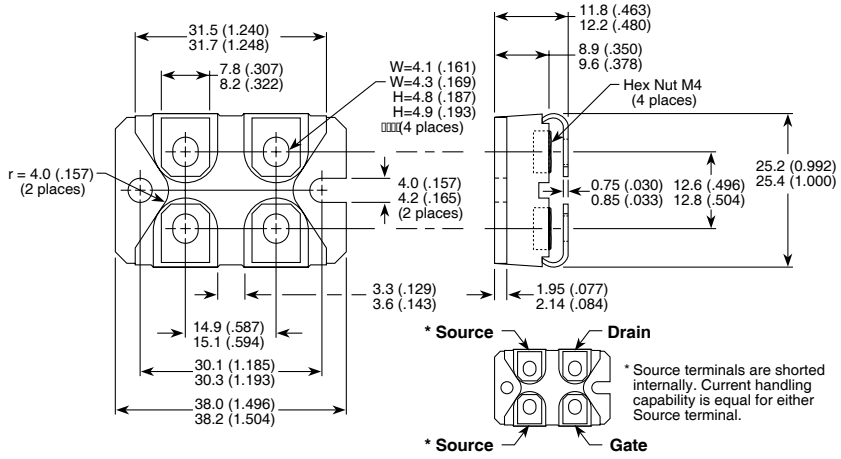


Figure 20, Inductive Switching Test Circuit

SOT-227 (ISOTOP®) Package Outline



Dimensions in Millimeters and (Inches)

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