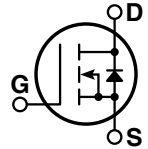


### Super Junction MOSFET



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



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:  $T_C = 25^\circ\text{C}$  unless otherwise specified.

Symbol	Parameter	APT31N80JC3	UNIT
$V_{DSS}$	Drain-Source Voltage	800	Volts
$I_D$	Continuous Drain Current @ $T_C = 25^\circ\text{C}$	31	Amps
$I_{DM}$	Pulsed Drain Current <sup>①</sup>	93	
$V_{GS}$	Gate-Source Voltage Continuous	$\pm 20$	Volts
$V_{GSM}$	Gate-Source Voltage Transient	$\pm 30$	
$P_D$	Total Power Dissipation @ $T_C = 25^\circ\text{C}$	833	Watts
	Linear Derating Factor	6.67	W/ $^\circ\text{C}$
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to 150	$^\circ\text{C}$
$T_L$	Lead Temperature: 0.063" from Case for 10 Sec.	300	
$dv/dt$	Drain-Source Voltage slope ( $V_{DS} = 640\text{V}$ , $I_D = 31\text{A}$ , $T_J = 125^\circ\text{C}$ )	50	V/ns
$I_{AR}$	Repetitive Avalanche Current <sup>⑦</sup>	17	Amps
$E_{AR}$	Repetitive Avalanche Energy <sup>⑦</sup>	0.5	mJ
$E_{AS}$	Single Pulse Avalanche Energy <sup>④</sup>	670	

#### STATIC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
$BV_{DSS}$	Drain-Source Breakdown Voltage ( $V_{GS} = 0\text{V}$ , $I_D = 500\mu\text{A}$ )	800			Volts
$R_{DS(on)}$	Drain-Source On-State Resistance <sup>②</sup> ( $V_{GS} = 10\text{V}$ , $I_D = 22\text{A}$ )		0.125	0.145	Ohms
$I_{DSS}$	Zero Gate Voltage Drain Current ( $V_{DS} = 800\text{V}$ , $V_{GS} = 0\text{V}$ )		0.5	25	$\mu\text{A}$
	Zero Gate Voltage Drain Current ( $V_{DS} = 800\text{V}$ , $V_{GS} = 0\text{V}$ , $T_J = 150^\circ\text{C}$ )			250	
$I_{GSS}$	Gate-Source Leakage Current ( $V_{GS} = \pm 20\text{V}$ , $V_{DS} = 0\text{V}$ )			$\pm 200$	nA
$V_{GS(th)}$	Gate Threshold Voltage ( $V_{DS} = V_{GS}$ , $I_D = 2\text{mA}$ )	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>

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### DYNAMIC CHARACTERISTICS

APT31N80JC3

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
$C_{iss}$	Input Capacitance	$V_{GS} = 0V$ $V_{DS} = 25V$ $f = 1\text{ MHz}$		4510		pF
$C_{oss}$	Output Capacitance			2050		
$C_{rss}$	Reverse Transfer Capacitance			110		
$Q_g$	Total Gate Charge ③	$V_{GS} = 10V$ $V_{DD} = 400V$ $I_D = 31A @ 25^\circ C$		180	355	nC
$Q_{gs}$	Gate-Source Charge			22		
$Q_{gd}$	Gate-Drain ("Miller") Charge			90		
$t_{d(on)}$	Turn-on Delay Time	<b>RESISTIVE SWITCHING</b> $V_{GS} = 10V$ $V_{DD} = 400V$ $I_D = 31A @ 125^\circ C$ $R_G = 2.5\Omega$		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	<b>INDUCTIVE SWITCHING @ 25^\circ C</b> $V_{DD} = 533V, V_{GS} = 15V$ $I_D = 31A, R_G = 5\Omega$		615		$\mu J$
$E_{off}$	Turn-off Switching Energy			530		
$E_{on}$	Turn-on Switching Energy ⑥	<b>INDUCTIVE SWITCHING @ 125^\circ C</b> $V_{DD} = 533V, V_{GS} = 15V$ $I_D = 31A, R_G = 5\Omega$		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 ( $I_S = -31A, di_S/dt = 100A/\mu s, V_R = 400V$ )		855		ns
$Q_{rr}$	Reverse Recovery Charge ( $I_S = -31A, di_S/dt = 100A/\mu s, V_R = 400V$ )		30		$\mu C$
$dv/dt$	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	$^\circ C/W$
$R_{\theta JA}$	Junction to Ambient			62	

① Repetitive Rating: Pulse width limited by maximum junction temperature

② Pulse Test: Pulse width < 380  $\mu s$ , Duty Cycle < 2%

③ See MIL-STD-750 Method 3471

④ Starting  $T_j = +25^\circ C$ ,  $L = 115.92mH$ ,  $R_G = 25\Omega$ , Peak  $I_L = 3.4A$

⑤  $I_S = -31A$   $di_S/dt = 100A/\mu s$   $v_R = 480V$   $T_j = 125^\circ C$

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

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

Microsemi reserves the right to change, without notice, the specifications and information contained herein.

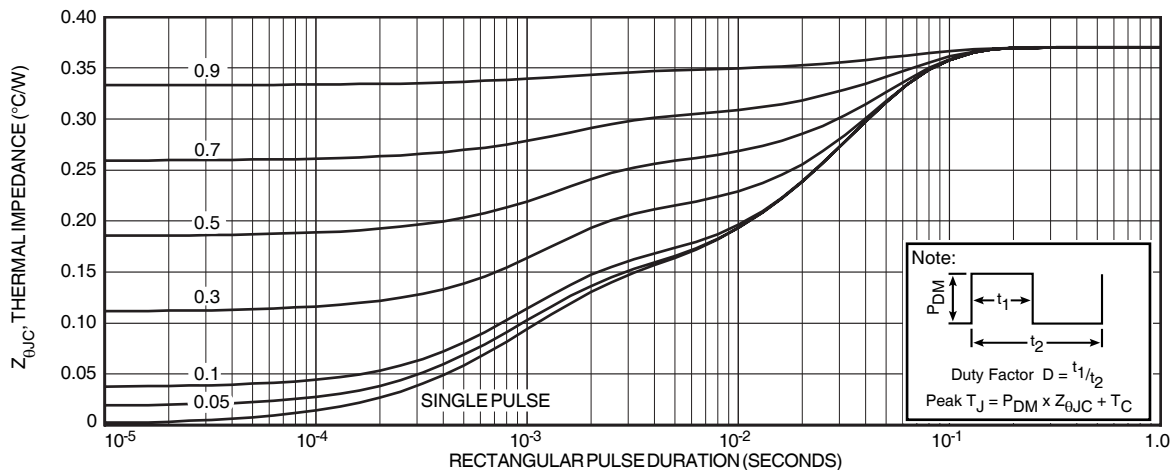


FIGURE 1, MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs PULSE DURATION

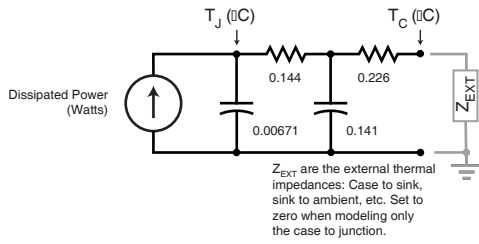


FIGURE 2, TRANSIENT THERMAL IMPEDANCE MODEL

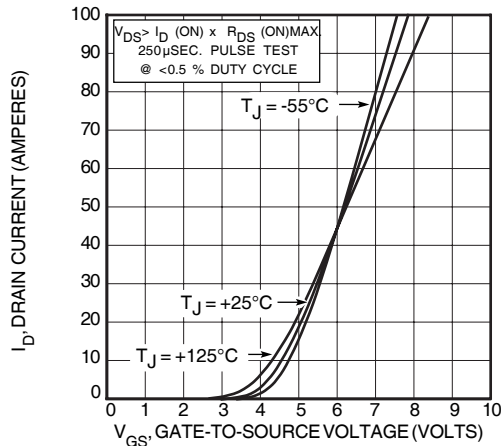


FIGURE 4, TRANSFER CHARACTERISTICS

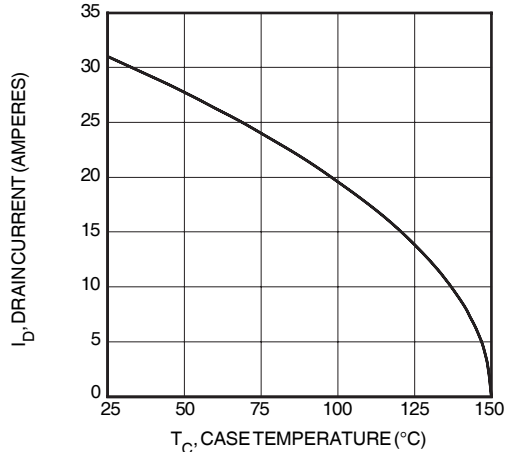


FIGURE 6, MAXIMUM DRAIN CURRENT vs CASE TEMPERATURE

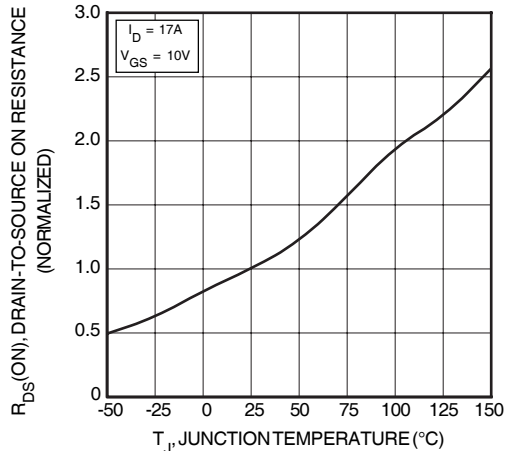


FIGURE 8, ON-RESISTANCE vs. TEMPERATURE

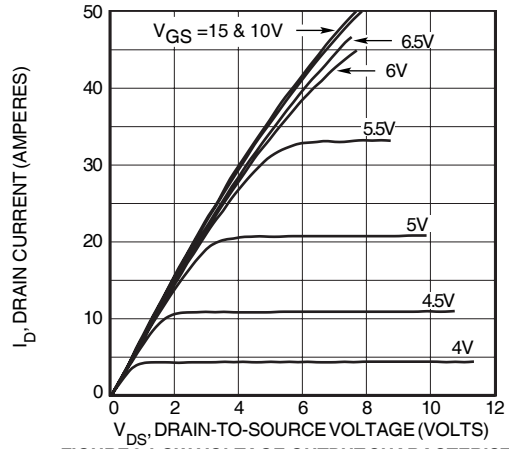


FIGURE 3, LOW VOLTAGE OUTPUT CHARACTERISTICS

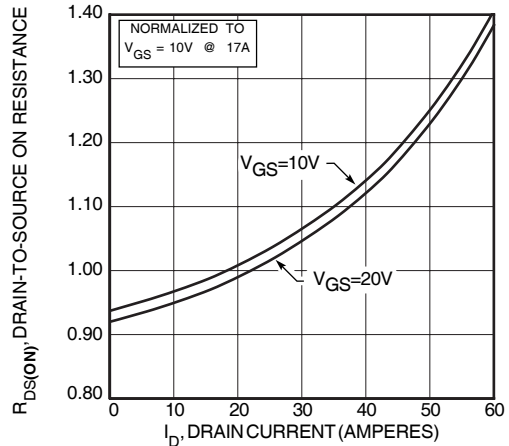


FIGURE 5,  $R_{DS(ON)}$  vs DRAIN CURRENT

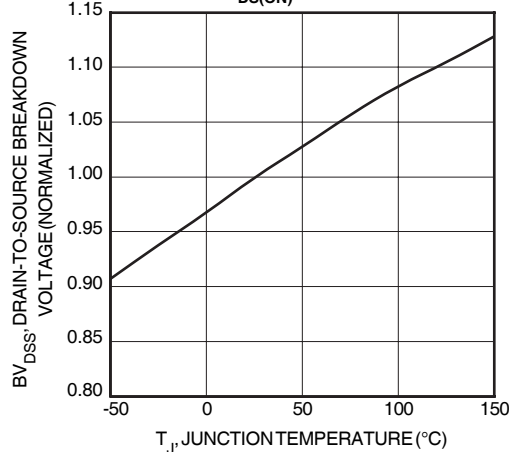


FIGURE 7, BREAKDOWN VOLTAGE vs TEMPERATURE

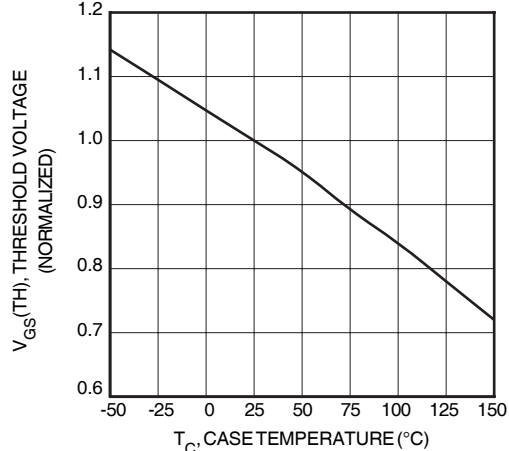
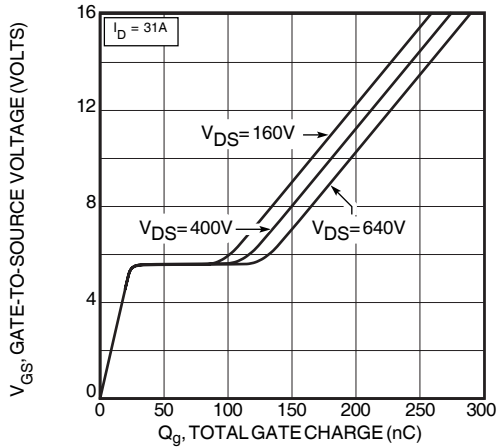


FIGURE 9, THRESHOLD VOLTAGE vs TEMPERATURE

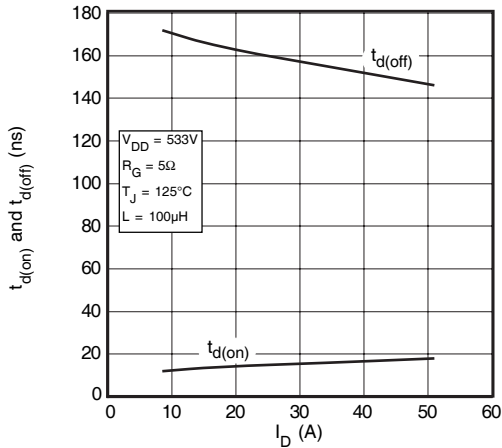
$I_D$ , DRAIN CURRENT (AMPERES)

Graph removed

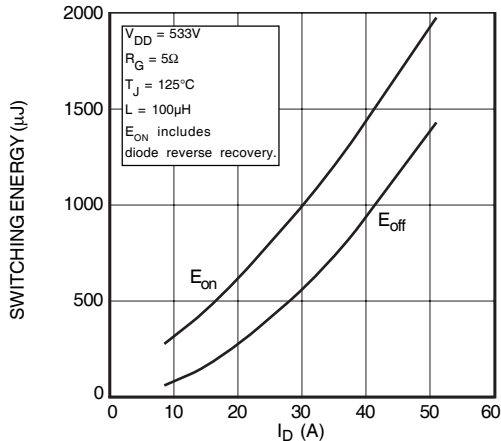
$V_{DS}$ , DRAIN-TO-SOURCE VOLTAGE (VOLTS)  
**FIGURE 10, MAXIMUM SAFE OPERATING AREA**



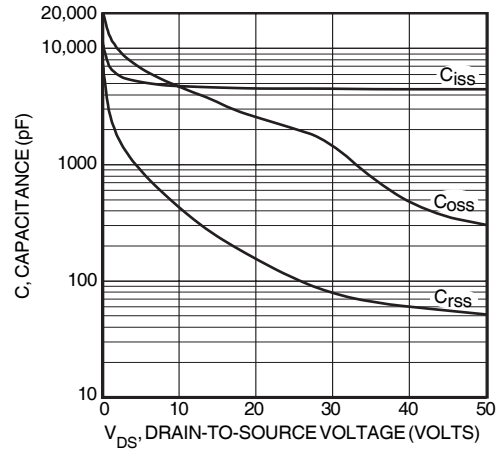
**FIGURE 12, GATE CHARGES vs GATE-TO-SOURCE VOLTAGE**



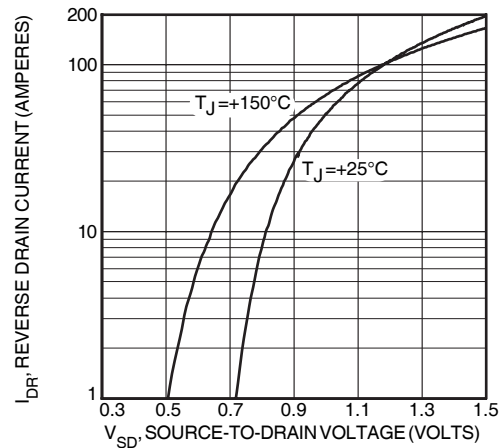
**FIGURE 14, DELAY TIMES vs CURRENT**



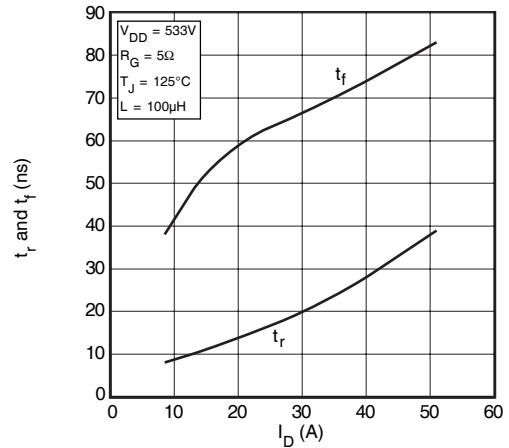
**FIGURE 16, SWITCHING ENERGY vs CURRENT**



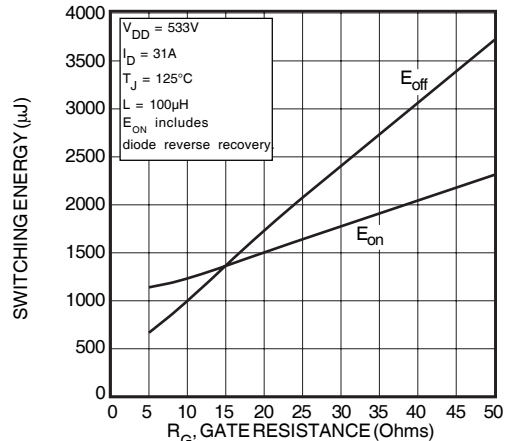
**FIGURE 11, CAPACITANCE vs DRAIN-TO-SOURCE VOLTAGE**



**FIGURE 13, SOURCE-DRAIN DIODE FORWARD VOLTAGE**



**FIGURE 15, RISE AND FALL TIMES vs CURRENT**



**FIGURE 17, SWITCHING ENERGY vs. GATE RESISTANCE**

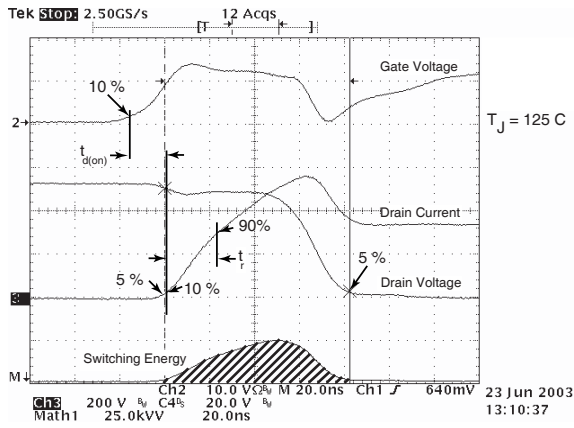


Figure 18, Turn-on Switching Waveforms and Definitions

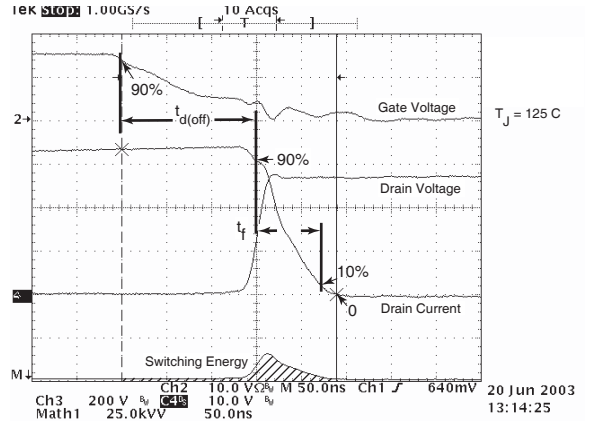


Figure 19, Turn-off Switching Waveforms and Definitions

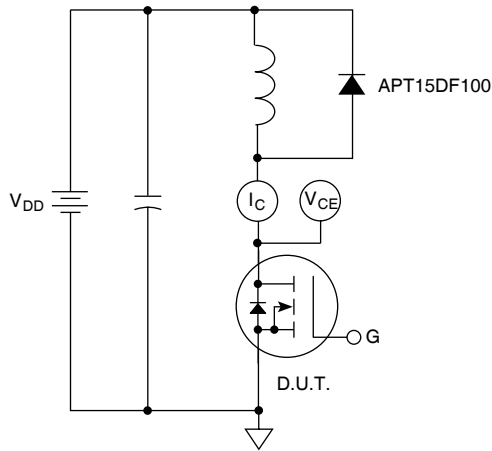
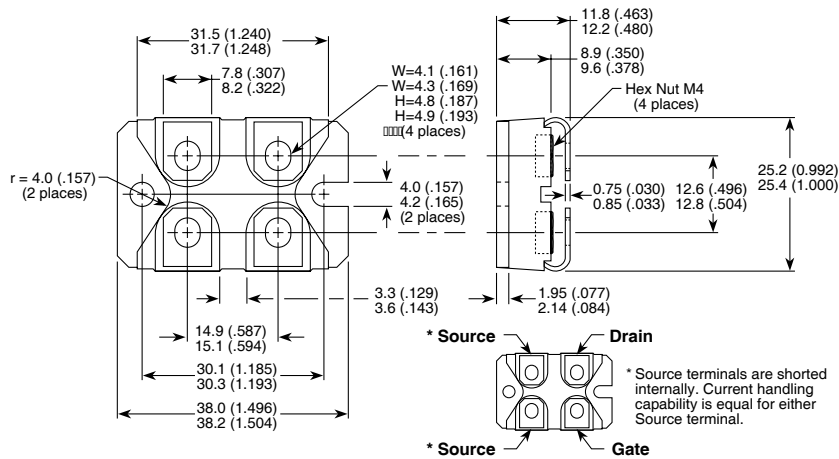


Figure 20, Inductive Switching Test Circuit

SOT-227 (ISOTOP®) Package Outline



Dimensions in Millimeters and (Inches)

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