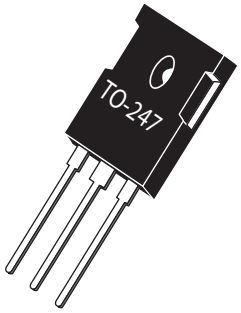
APT47N65BC3

650V 47A 0.070Ω

Super Junction MOSFET



- **Ultra low $R_{DS(ON)}$**
- **Increased Power Dissipation**
- **Low Miller Capacitance**
- **Ultra Low Gate Charge, Q_g**
- **Avalanche Energy Rated**
- **TO-247 or Surface Mount D^3PAK Package**

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

Symbol	Parameter	APT47N65BC3	UNIT
V_{DSS}	Drain-Source Voltage	650	Volts
I_D	Continuous Drain Current @ T_C = 25°C	47	Amps
I_{DM}	Pulsed Drain Current [1]	141	
V_{GS}	Gate-Source Voltage Continuous	±20	Volts
V_{GSM}	Gate-Source Voltage Transient	±30	
P_D	Total Power Dissipation @ T_C = 25°C	417	Watts
	Linear Derating Factor	3.33	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.	260	
dv/dt	Drain-Source Voltage slope (V_{DS} = 480V, I_D = 47A, 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	

STATIC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
BV_{DSS}	Drain-Source Breakdown Voltage (V_{GS} = 0V, I_D = 250µA)	650			Volts
$R_{DS(on)}$	Drain-Source On-State Resistance [2] (V_{GS} = 10V, I_D = 30A)		0.06	0.07	Ohms
I_{DSS}	Zero Gate Voltage Drain Current (V_{DS} = 650V, V_{GS} = 0V)		0.5	25	µA
	Zero Gate Voltage Drain Current (V_{DS} = 650V, V_{GS} = 0V, T_J = 150°C)			250	
I_{GSS}	Gate-Source Leakage Current (V_{GS} = ±20V, V_{DS} = 0V)			±100	nA
$V_{GS(th)}$	Gate Threshold Voltage (V_{DS} = V_{GS}, I_D = 2.7mA)	2.10	3	3.9	Volts

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

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DYNAMIC CHARACTERISTICS

APT47N65BC3

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
C_{iss}	Input Capacitance	V_{GS} = 0V V_{DS} = 25V f = 1 MHz		7015	6965	pF
C_{oss}	Output Capacitance			2565	2100	
C_{rss}	Reverse Transfer Capacitance			210	85	
Q_g	Total Gate Charge [3]	V_{GS} = 10V V_{DD} = 300V I_D = 47A @ 25°C		260	250	nC
Q_{gs}	Gate-Source Charge			29	30	
Q_{gd}	Gate-Drain ("Miller") Charge			110	105	
$t_{d(on)}$	Turn-on Delay Time	**INDUCTIVE SWITCHING** V_{GS} = 13V V_{DD} = 380V I_D = 47A @ 125°C R_G = 5Ω		18	18	ns
t_r	Rise Time			27	28	
$t_{d(off)}$	Turn-off Delay Time			110	295	
t_f	Fall Time			8	84	
E_{on}	Turn-on Switching Energy [6]	**INDUCTIVE SWITCHING @ 25℃** V_{DD} = 400V, V_{GS} = 15V I_D = 47A, R_G = 5Ω		670	775	µJ
E_{off}	Turn-off Switching Energy			980	860	
E_{on}	Turn-on Switching Energy [6]	**INDUCTIVE SWITCHING @ 125℃** V_{DD} = 400V V_{GS} = 15V I_D = 47A, R_G = 5Ω		1100	1172	
E_{off}	Turn-off Switching Energy			1200	985	

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
I_S	Continuous Source Current (Body Diode)			47	Amps
I_{SM}	Pulsed Source Current [1] (Body Diode)			141	
V_{SD}	Diode Forward Voltage [2] (V_{GS} = 0V, I_S = -47A)			1.2	Volts
t_{rr}	Reverse Recovery Time (I_S = -47A, dI_S/dt = 100A/µs, V_R = 350V)		580	650	ns
Q_{rr}	Reverse Recovery Charge (I_S = -47A, dI_S/dt = 100A/µs, V_R = 350V)		23	16.5	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			0.30	°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 = $-I_D$47A , $^{di}/_{dt}$ = 700A/µs $V_R = V_{DSS}$, T_J = 150°C

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

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

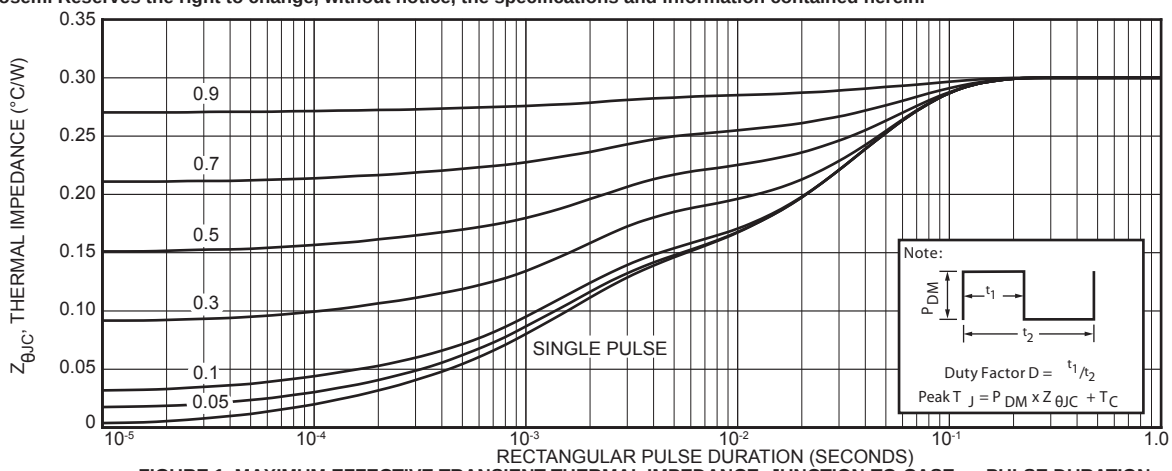


FIGURE 1, MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs PULSE DURATION

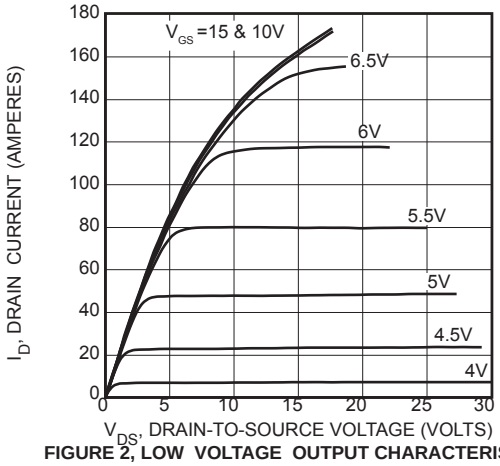


FIGURE 2, LOW VOLTAGE OUTPUT CHARACTERISTICS

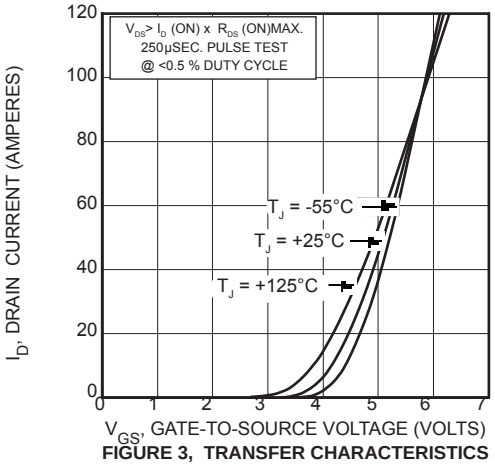


FIGURE 3, TRANSFER CHARACTERISTICS

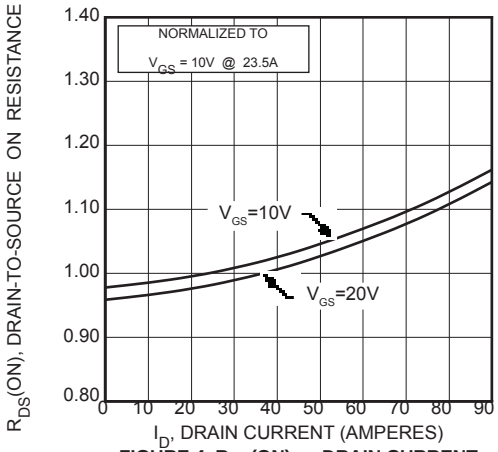


FIGURE 4, R_{DS}(ON) vs DRAIN CURRENT

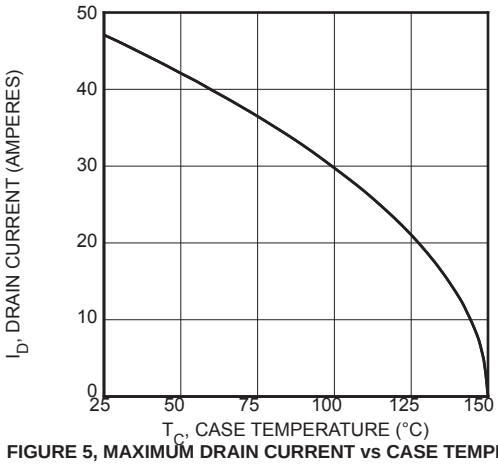


FIGURE 5, MAXIMUM DRAIN CURRENT vs CASE TEMPERATURE

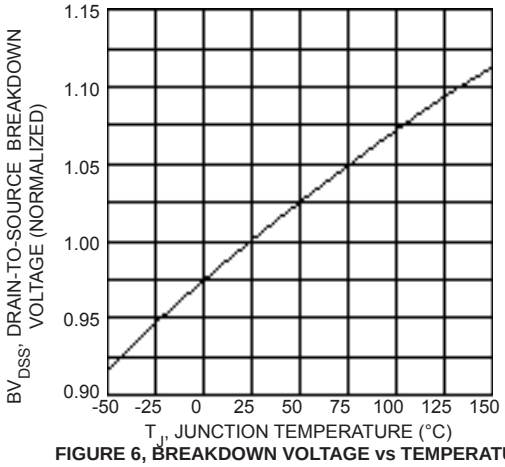


FIGURE 6, BREAKDOWN VOLTAGE vs TEMPERATURE

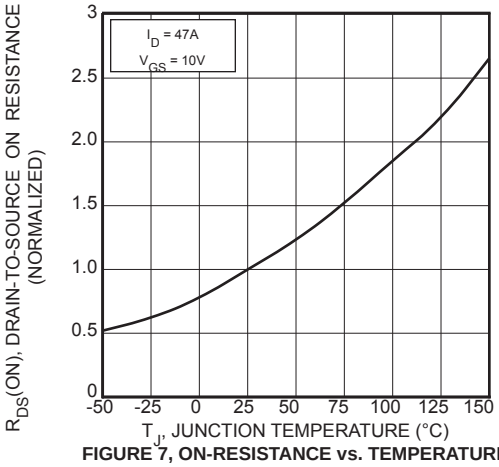


FIGURE 7, ON-RESISTANCE vs. TEMPERATURE

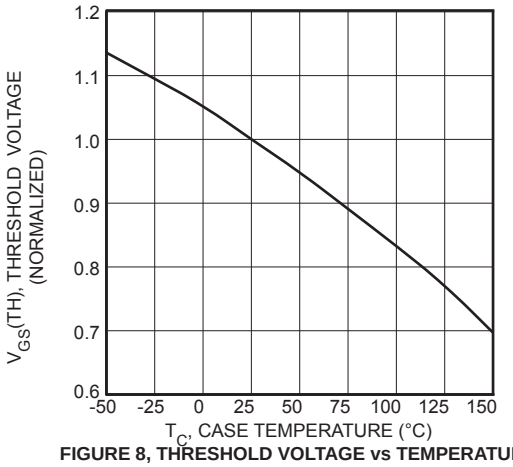


FIGURE 8, THRESHOLD VOLTAGE vs TEMPERATURE

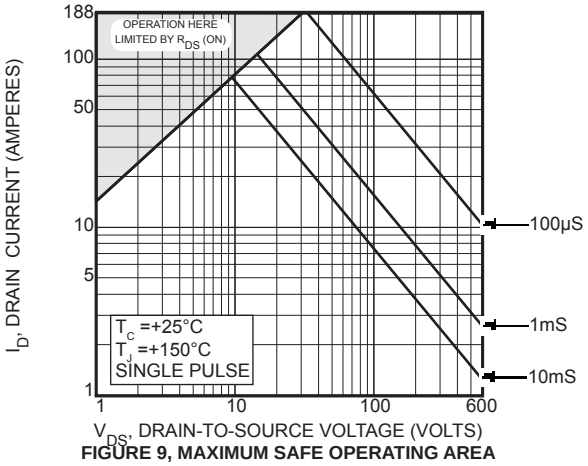


FIGURE 9, MAXIMUM SAFE OPERATING AREA

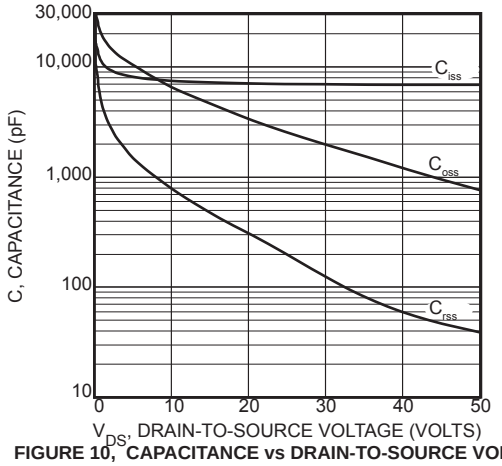


FIGURE 10, CAPACITANCE vs DRAIN-TO-SOURCE VOLTAGE

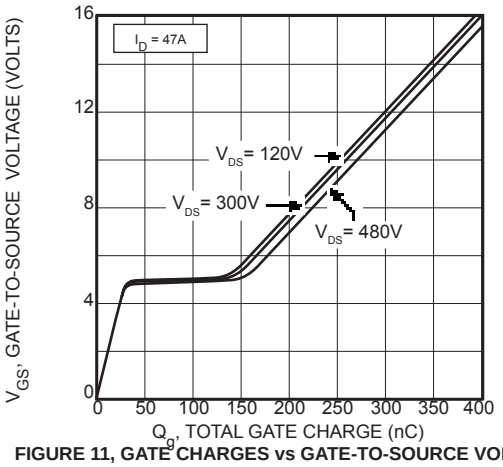


FIGURE 11, GATE CHARGES vs GATE-TO-SOURCE VOLTAGE

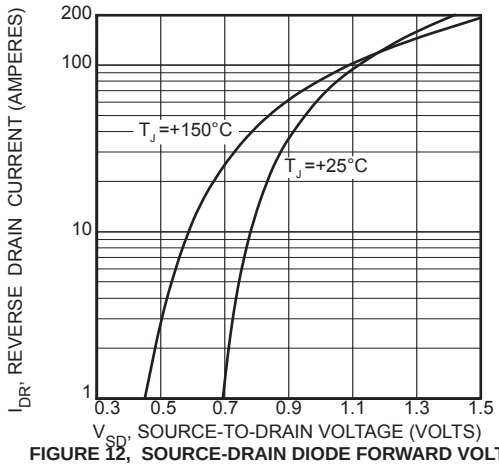


FIGURE 12, SOURCE-DRAIN DIODE FORWARD VOLTAGE

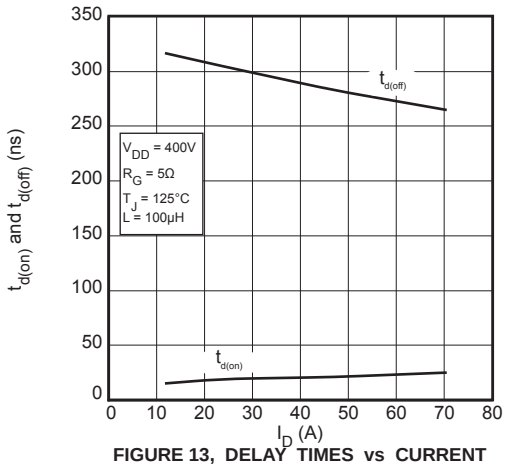


FIGURE 13, DELAY TIMES vs CURRENT

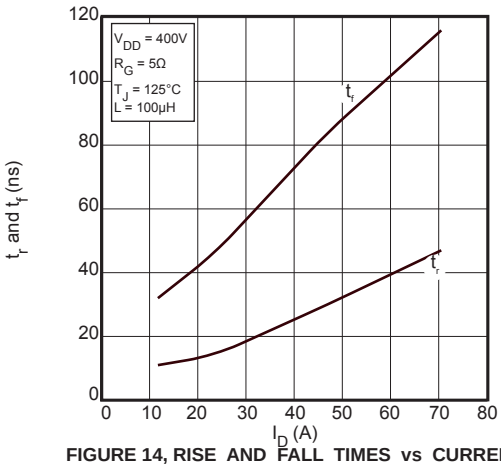


FIGURE 14, RISE AND FALL TIMES vs CURRENT

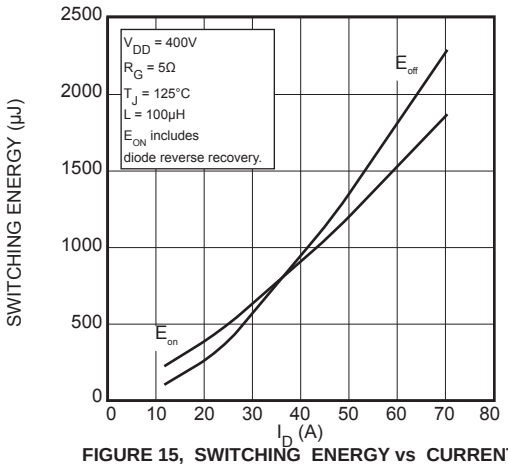


FIGURE 15, SWITCHING ENERGY vs CURRENT

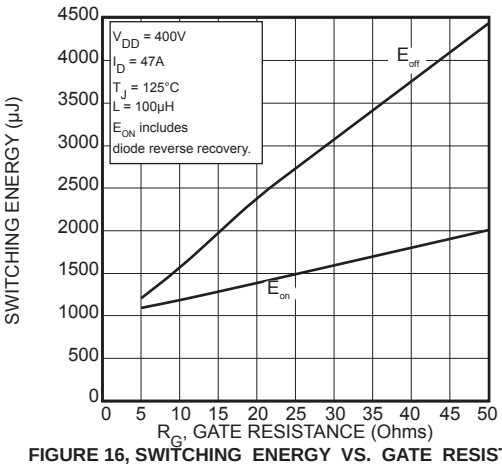


FIGURE 16, SWITCHING ENERGY VS. GATE RESISTANCE

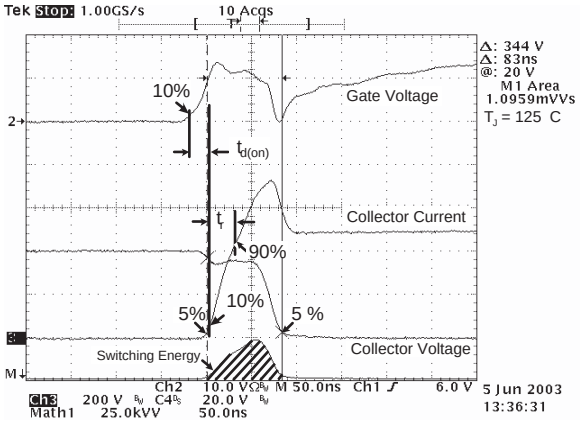


Figure 18, Turn-on Switching Waveforms and Definitions

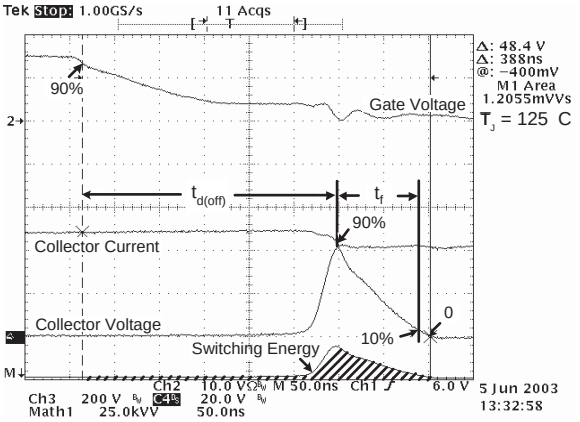


Figure 19, Turn-off Switching Waveforms and Definitions

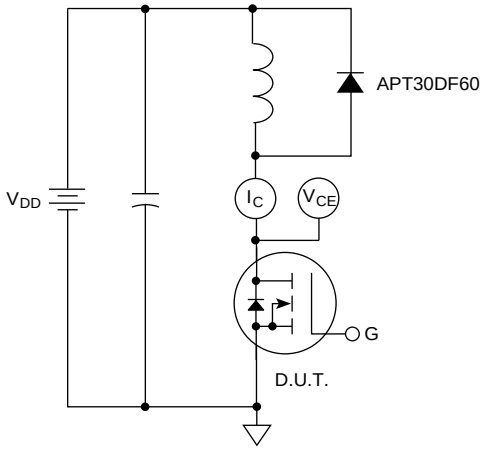
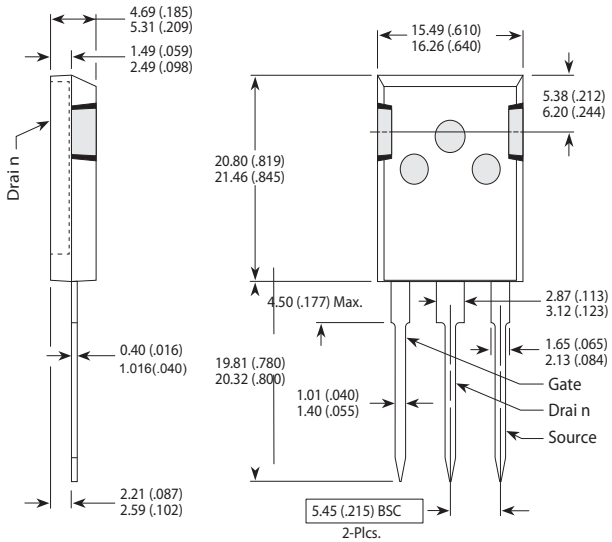


Figure 20, Inductive Switching Test Circuit

TO-247 Package Outline



These dimensions are equal to the TO-247 without the mounting hole.

Dimensions in Millimeters and (Inches)