Silicon Carbide (SiC) MOSFET – 14 mohm, 1200 V, M3, D2PAK-7L

NTBG014N120M3P

$V_{(BR)DSS}$	$R_{DS(ON)}$ MAX	I_D MAX
1200 V	20 mΩ @ 18 V	104 A

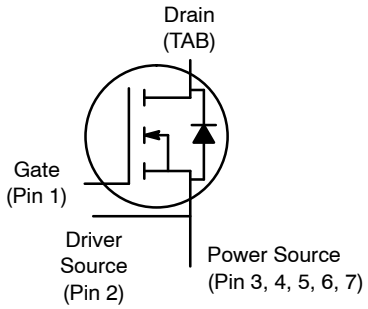
Features

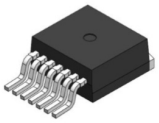
- Typ. $R_{DS(on)}$ = 14 mΩ
- Low Switching Losses (Typ. E_{ON} 1331 μJ at 74 A, 800 V)
- 100% Avalanche Tested

Typical Applications

- Solar Inverters
- Electric Vehicle Charging Stations
- UPS (Uninterruptible Power Supplies)
- Energy Storage Systems
- SMPS (Switch Mode Power Supplies)

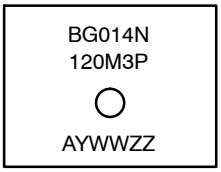
N−CHANNEL MOSFET





D2PAK−7L
CASE 418BJ

MARKING DIAGRAM



A	= Assembly Location
Y	= Year
WW	= Work Week
ZZ	= Lot Traceability
BG014N120M3P	= Specific Device Code

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

Symbol	Parameter			Value	Unit
V_{DSS}	Drain−to−Source Voltage			1200	V
V_{GS}	Gate−to−Source Voltage			−10 +22	V
V_{GSop}	Recommended Operation Values of Gate−Source Voltage	T_C < 175°C		−3/+18	V
I_D	Continuous Drain Current $R_{\theta JC}$ (Note 2)	Steady State	T_C = 25°C	104	A
P_D	Power Dissipation $R_{\theta JC}$ (Note 2)			454	W
I_D	Continuous Drain Current $R_{\theta JC}$ (Note 1, 2)	Steady State	T_C = 100°C	73	A
P_D	Power Dissipation $R_{\theta JC}$ (Note 1, 2)			227	W
I_{DM}	Pulsed Drain Current (Note 3)	T_A = 25°C		257	A
T_J, T_{STG}	Operating Junction and Storage Temperature			−55 to 175	°C
I_S	Source Current (Body Diode) T_C = 25°C, V_{GS} = −3 V			92	A
E_{AS}	Single Pulse Drain−to−Source Avalanche Energy (Note 5) (I_L = 28.9 A_{pk}, L = 1 mH) (Note 4)			418	mJ
T_L	Maximum Lead Temperature for Soldering, 1/8″ from Case for 10 seconds			245	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Surface mounted on a FR−4 board using 1 in^2 pad of 2 oz copper.
2. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
3. Repetitive rating, limited by max junction temperature.
4. Peak current might be limited by transconductance.
5. E_{AS} of 418 mJ is based on starting T_J = 25°C; L = 1 mH, I_{AS} = 28.9 A, V_{DD} = 100 V, V_{GS} = 18 V.

ORDERING INFORMATION

Device	Package	Shipping†
NTBG014N120M3P	D2PAK−7L	800 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

THERMAL CHARACTERISTICS

Symbol	Parameter	Typ	Max	Unit
$R_{\theta JC}$	Thermal Resistance Junction−to−Case (Note 2)	0.33	−	°C/W
$R_{\theta JA}$	Thermal Resistance Junction−to−Ambient (Note 1, 2)	−	40	°C/W

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
OFF−STATE CHARACTERISTICS						
$V_{(BR)DSS}$	Drain−to−Source Breakdown Voltage	V_{GS} = 0 V, I_D = 1 mA	1200			V
$V_{(BR)DSS}$ / T_J	Drain−to−Source Breakdown Voltage Temperature Coefficient	I_D = 1 mA, refer to 25°C		0.3		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{GS} = 0 V, V_{DS} = 1200 V, T_J = 25°C			100	μA
I_{GSS}	Gate−to−Source Leakage Current	V_{GS} = +22/−10 V, V_{DS} = 0 V			±1	μA
ON−STATE CHARACTERISTICS						
$V_{GS(TH)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 37 mA	2.08	3.0	4.63	V
V_{GOP}	Recommended Gate Voltage		−3		+18	V
$R_{DS(on)}$	Drain−to−Source On Resistance	V_{GS} = 18 V, I_D = 74 A, T_J = 25°C		14	20	mΩ
		V_{GS} = 18 V, I_D = 74 A, T_J = 175°C		29		mΩ
		V_{GS} = 15 V, I_D = 74 A, T_J = 25°C		16	27	mΩ
		V_{GS} = 15 V, I_D = 74 A, T_J = 150°C		27		mΩ
g_{FS}	Forward Transconductance	V_{DS} = 10 V, I_D = 74 A		29		S
CHARGES, CAPACITANCES & GATE RESISTANCE						
C_{ISS}	Input Capacitance	V_{GS} = 0 V, f = 1 MHz, V_{DS} = 800 V		6313		pF
C_{OSS}	Output Capacitance			259		
C_{RSS}	Reverse Transfer Capacitance			27		
$Q_{G(TOT)}$	Total Gate Charge	V_{GS} = −3/18 V, V_{DS} = 800 V, I_D = 74 A		337		nC
$Q_{G(TH)}$	Threshold Gate Charge			43		
Q_{GS}	Gate−to−Source Charge			78		
Q_{GD}	Gate−to−Drain Charge			98		
R_G	Gate Resistance	f = 1 MHz		1.4		Ω
SWITCHING CHARACTERISTICS						
$t_{d(ON)}$	Turn−On Delay Time	V_{GS} = −3/18 V, V_{DS} = 800 V, I_D = 74 A, R_G = 2 Ω Inductive Load (Note 6)		24		ns
t_r	Rise Time			40		
$t_{d(OFF)}$	Turn−Off Delay Time			74		
t_f	Fall Time			14		
E_{ON}	Turn−On Switching Loss			1331		μJ
E_{OFF}	Turn−Off Switching Loss			620		
E_{TOT}	Total Switching Loss			1953		

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted) (continued)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
DRAIN−SOURCE DIODE CHARACTERISTICS						
I_{SD}	Continuous Drain−Source Diode Forward Current	V_{GS} = −3 V, T_C = 25°C			92	A
I_{SDM}	Pulsed Drain−Source Diode Forward Current (Note 3)	V_{GS} = −3 V, T_C = 25°C			257	A
V_{SD}	Forward Diode Voltage	V_{GS} = −3 V, I_{SD} = 74 A, T_J = 25°C		5.1		V
t_{RR}	Reverse Recovery Time	V_{GS} = −3/18 V, I_{SD} = 74 A, dI_S/dt = 1000 A/μs, V, V_{DS} = 800 V		37		ns
Q_{RR}	Reverse Recovery Charge			347		nC
E_{REC}	Reverse Recovery Energy			12		μJ
I_{RRM}	Peak Reverse Recovery Current			19		A
t_A	Charge Time			19		ns
t_B	Discharge Time			17		ns

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

6. E_{ON}/E_{OFF} result is with body diode.

TYPICAL CHARACTERISTICS

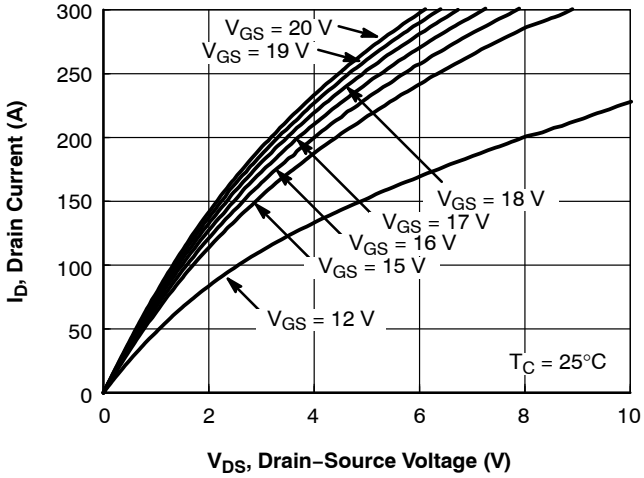


Figure 1. On−Region Characteristics

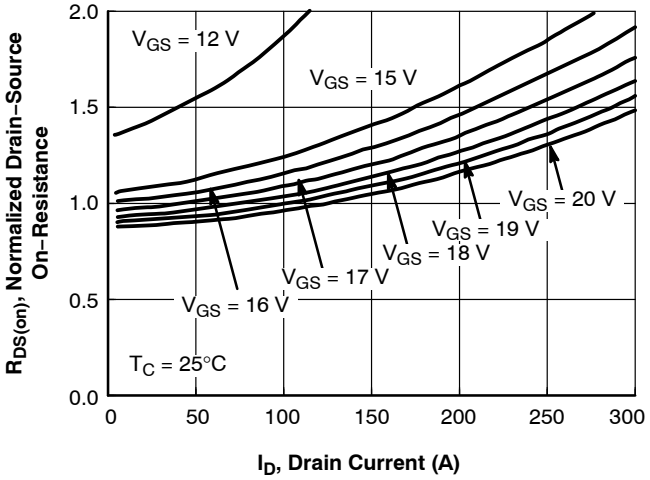


Figure 2. Normalized On−Resistance vs. Drain Current and Gate Voltage

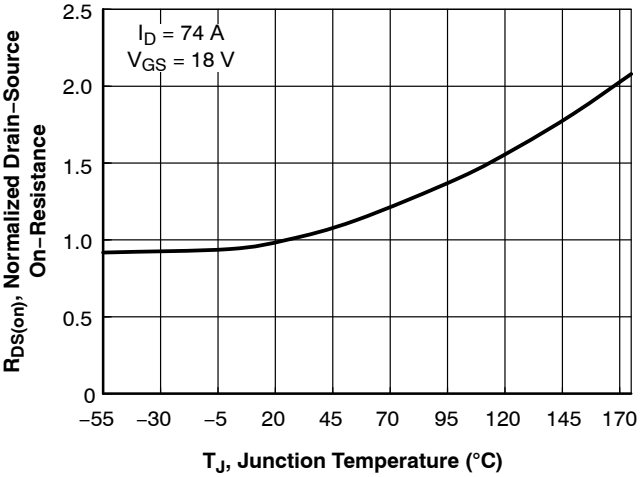


Figure 3. On−Resistance Variation with Temperature

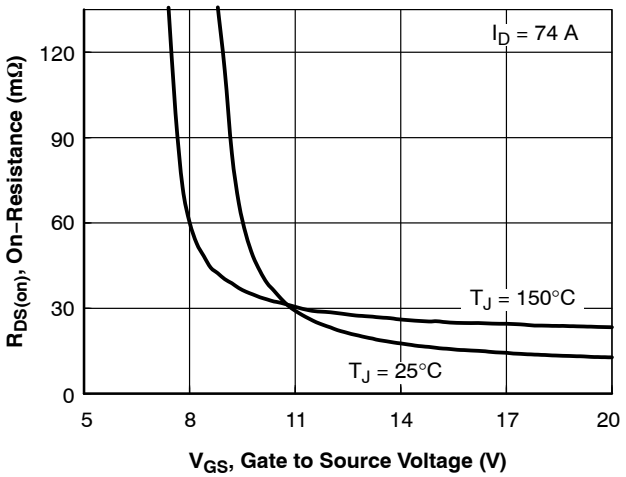


Figure 4. On−Resistance vs. Gate−to−Source Voltage

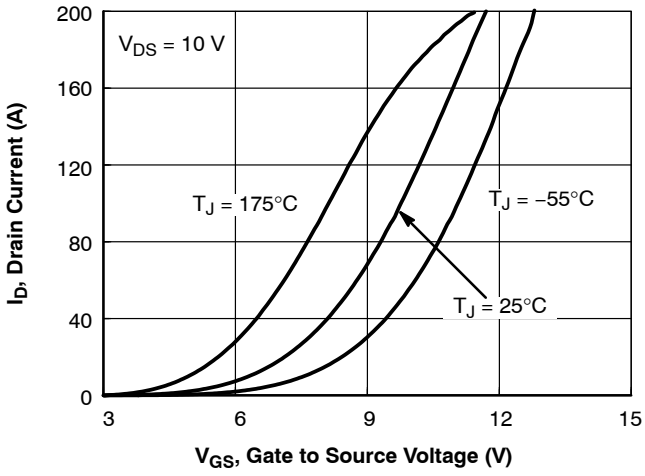


Figure 5. Transfer Characteristics

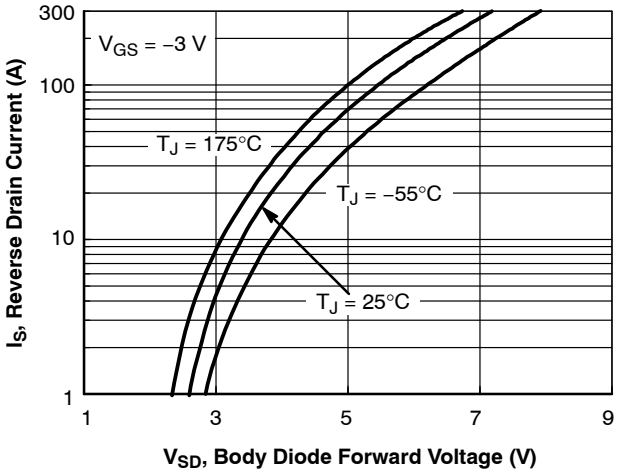


Figure 6. Diode Forward Voltage vs. Current

TYPICAL CHARACTERISTICS (continued)

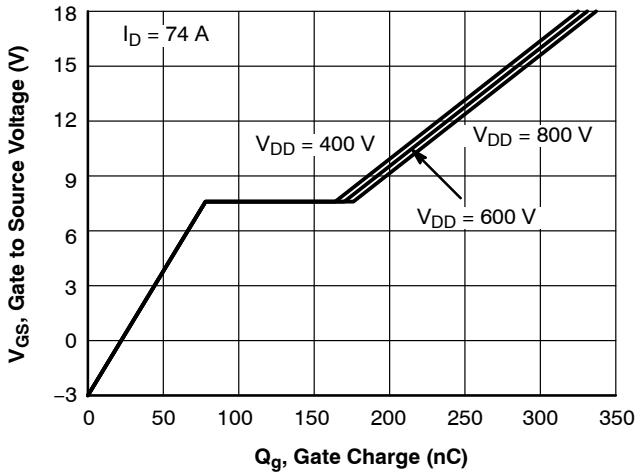


Figure 7. Gate−to−Source Voltage vs. Total Charge

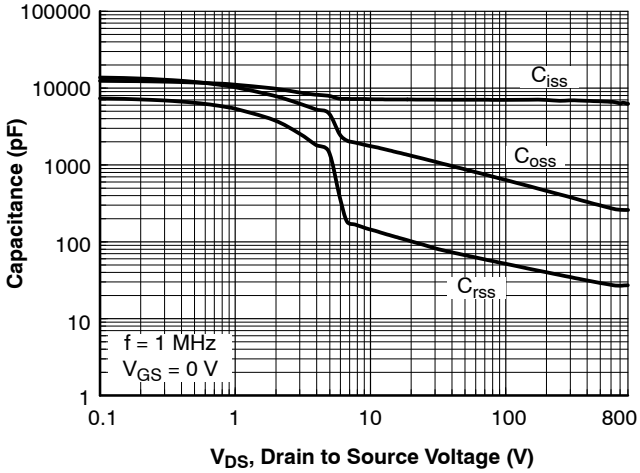


Figure 8. Capacitance vs. Drain to Source Voltage

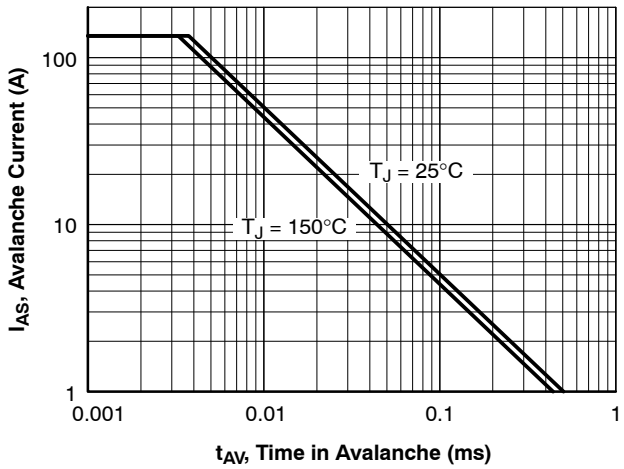


Figure 9. Unclamped Inductive Switching Capability

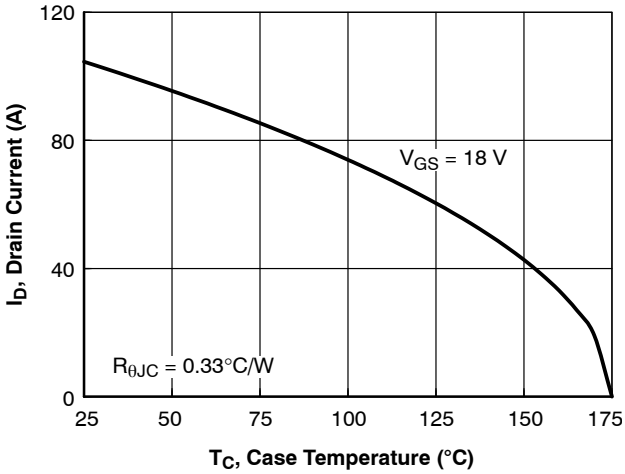


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

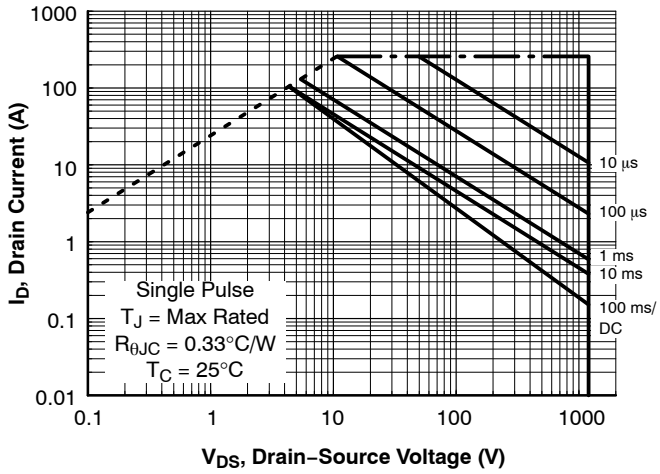


Figure 11. Safe Operating Area

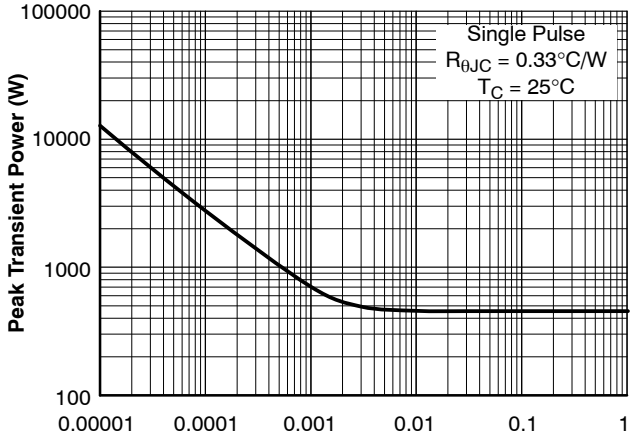


Figure 12. Single Pulse Maximum Power Dissipation

TYPICAL CHARACTERISTICS (continued)

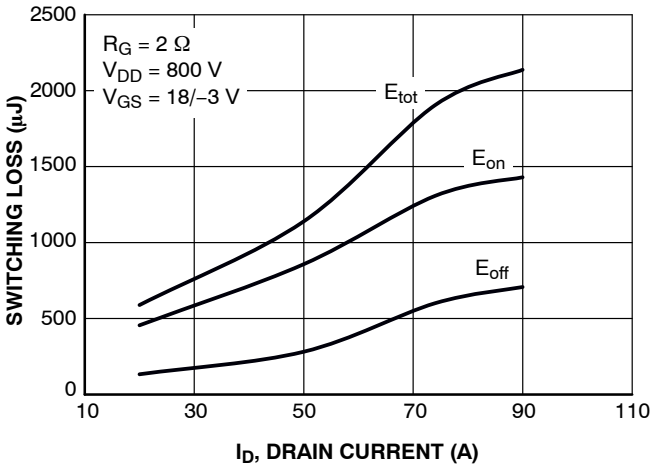


Figure 13. Switching Loss vs. Drain Current

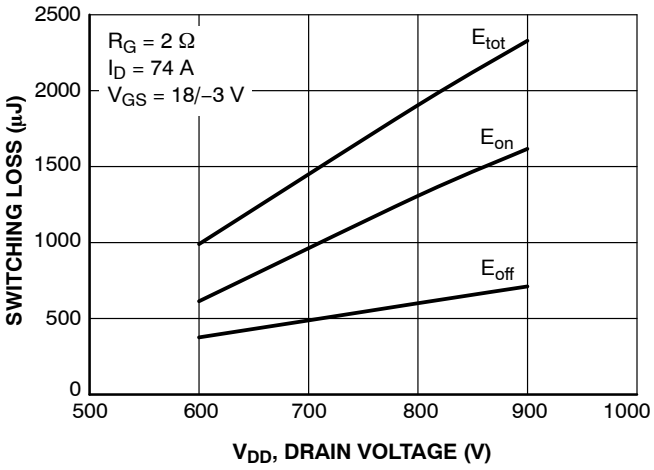


Figure 14. Switching Loss vs. Drain Voltage

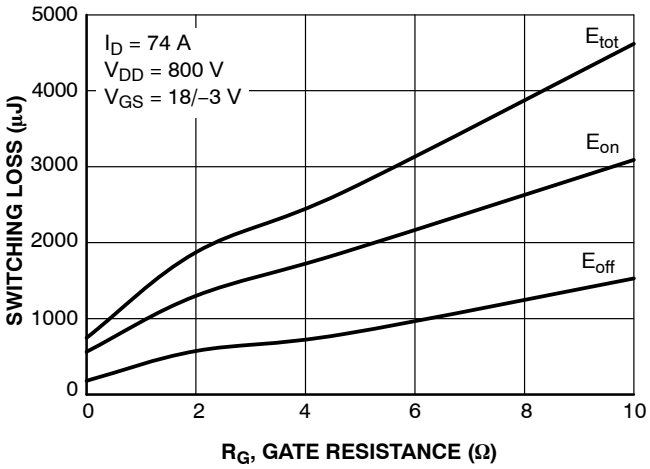


Figure 15. Switching Loss vs. Gate Resistance

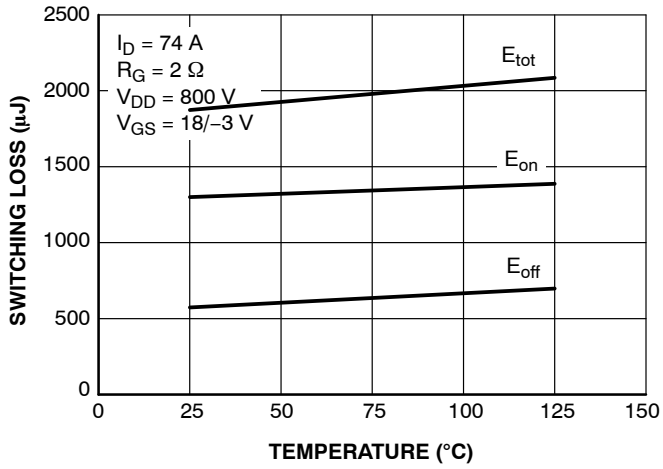


Figure 16. Switching Loss vs. Temperature

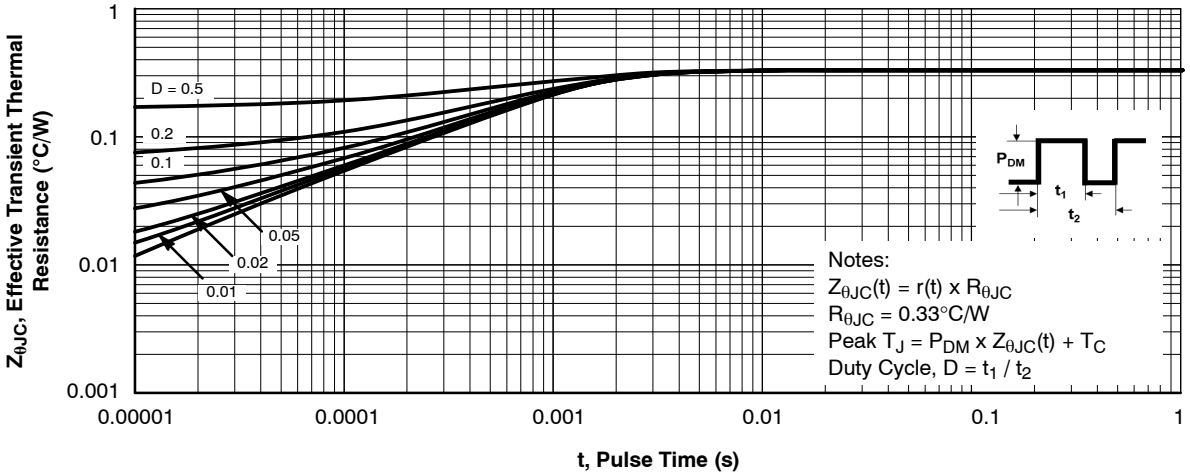


Figure 17. Junction−To−Case Transient Thermal Response Curve