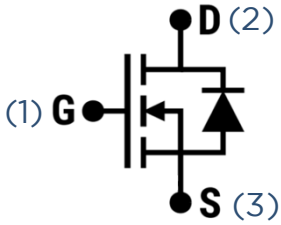
N3PT1000MP170D
1700 V 1000 mΩ Silicon Carbide MOSFET

V_{DS}	I_D	$R_{DS(on)}$	Package
1700 V	5.1 A	1000 mΩ	TO-247-3



(1) (2) (3)

Features
- State-of-the-art SiC MOSFET technology
- Reliable gate oxide process
- Stable switching characteristics up to 175 °C
- Ultra-efficient edge termination
- Rugged dv/dt capability

Benefits
- Higher system efficiency
- Reduced cooling requirements
- Increased power density
- Increased system switching frequency
- Enhanced system reliability
- Reduced total harmonic distortion

Applications
- EV, renewable, and energy storage (string-level conversion and insulation/isolation monitoring, solid-state relay, pre-charge circuits, auxiliary DC/DC, sensing)
- Rail & utility (pre-charge, bleed, voltage sensing)
- Industrial drives (control & protection)
- Defense & aerospace auxiliaries (radar, avionics, directed energy, pulse power)

Maximum Ratings

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit	Note
Drain-Source Voltage	$V_{(BR)DSS}$	T_C = 25 °C	1700	-	-	V	
Gate-Source Voltage	$V_{GS(max)}$		-10	-	25	V	
	$V_{GS,op}$	Recommended Operation	-	-5/+20	-		
Continuous Drain Current	I_D	V_{GS} = 20 V, T_C = 25 °C	-	-	5.1	A	Fig. 13
		V_{GS} = 20 V, T_C = 100 °C	-	-	3.6		
Pulsed Drain Current	$I_{D(pulse)}$	T_C = 25 °C	-	-	7.5	A	Fig. 12
Power Dissipation	P_{tot}	T_C = 25 °C	-	-	56	W	Fig. 14
Operating and Storage Temperature	T_J , T_{stg}		-55	-	175	°C	

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Thermal and Package Characteristics

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit	Note
Thermal Resistance, Junction to Case	$R_{th\,JC}$		-	2.3	2.7	°C/W	Fig. 11
Thermal Resistance, Junction to Ambient	$R_{th\,JA}$		-	-	40	°C/W	
Weight	W_T		-	6.1	-	g	
Solder Temperature	T_L	JEDEC J-STD-020	-	-	225	°C	
Mounting Torque	T_M	M3 or 6-32 screw	-	0.9	-	Nm	

Electrical Characteristics (T_C = 25 °C unless otherwise specified)

STATIC CHARACTERISTICS

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit	Note
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = 100 QA	1700	-	-	V	
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 0 V, V_{GS} = 0 V	-	1	100	QA	
Gate Threshold Voltage	$V_{GS(th)}$	V_{GS} = V_{DS}, I_D = 1 mA	1.9	2.9	4	V	
Gate-Source Leakage Current	I_{GSS}	V_{GS} = -10 / +25 V, V_{DS} = 0 V	-	-	3100	nA	
Transconductance	g_{fs}	V_{DS} = 10 V, I_D = 1 A	-	0.5	-	S	Fig. 8
Drain-Source On-State Resistance	$R_{DS(on)}$	V_{GS} = 20 V, I_D = 1 A	-	940	1000	mΩ	Fig. 1
		V_{GS} = 20 V, I_D = 1 A, T_C = 175 °C	-	2130	-	mΩ	Fig. 3
		V_{GS} = 18 V, I_D = 1 A	-	1000	-	mΩ	Fig. 1
		V_{GS} = 18 V, I_D = 1 A, T_C = 175 °C	-	2170	-	mΩ	Fig. 3

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DYNAMIC CHARACTERISTICS

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit	Note
Input Capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = 1000 V, V_{AC} = 25 mV, f = 1 MHz	-	120	-	pF	Fig. 10
Output Capacitance	C_{oss}		-	8.5	-		
Reverse Capacitance	C_{rss}		-	1.2	-		
Gate-Source Charge	Q_{GS}	V_{DS} = 1000 V, V_{GS} = -5 / +20 V, I_D = 2 A	-	9.5	-	nC	Fig. 15
Gate-Drain Charge	Q_{GD}		-	8.0	-		
Total Gate Charge	Q_G		-	29.5	-		
Internal Gate Resistance	$R_{G(int)}$	V_{AC} = 25 mV, f = 1 MHz	-	6.2	-	Ω	
Turn-On Switching Energy	E_{ON}	V_{DD} = 1200 V, I_D = 2 A, V_{GS} = -5 / +20 V, $R_{G(ext)}$ = 5 Ω, L = 500 QH	-	123	-	QJ	Fig. 16 Fig. 17 Fig. 18
Turn-Off Switching Energy	E_{OFF}		-	45	-		
Total Switching Energy	E_{TOT}		-	168	-		
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = 1200 V, I_D = 2 A, V_{GS} = -5 / +20 V, $R_{G(ext)}$ = 5 Ω, L = 500 QH Timing relative to V_{DS} Inductive Load	-	15	-	ns	Fig. 19
Rise Time	t_r		-	23	-		
Turn-Off Delay Time	$t_{d(off)}$		-	22	-		
Fall Time	t_f		-	72	-		

BODY DIODE CHARACTERISTICS

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit	Note
Diode Forward Voltage	V_{SD}	V_{GS} = -5 V, I_{SD} = 1 A	-	4.4	-	V	Fig. 20
		V_{GS} = -5 V, I_{SD} = 1 A, T_J = 175 °C	-	3.8	-	V	Fig. 21
Continuous Diode Forward Current	I_S	V_{GS} = -5 V	-	-	7.05	A	
Reverse Recovery Time	t_{rr}	V_R= 1200 V, I_{SD} = 2 A, V_{GS} = -5 V, diF/dt = 1000 A/Qs	-	6.2	-	ns	
Reverse Recovery Charge	Q_{rr}		-	14	-	nC	
Peak Reverse Recovery Current	I_{RRM}		-	4.3	-	A	

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Typical Performance

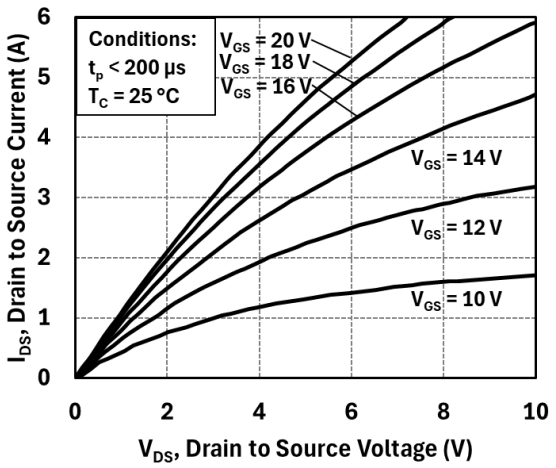


Figure 1: Output Characteristics at 25 °C

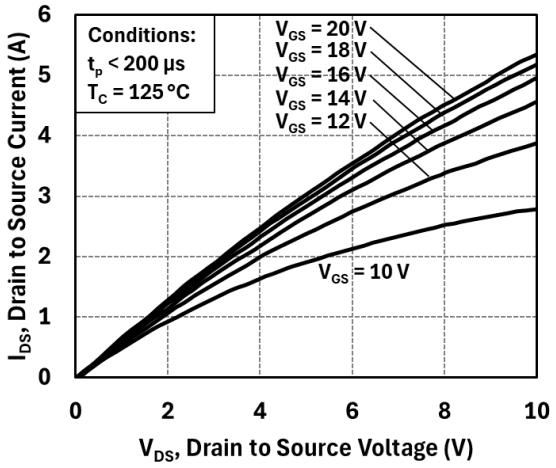


Figure 2: Output Characteristics at 125 °C

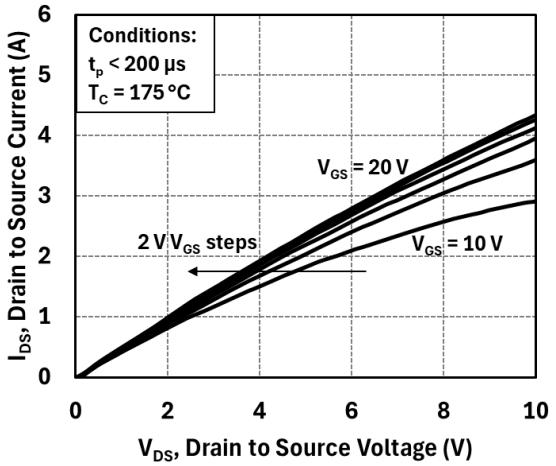


Figure 3: Output Characteristics at 175 °C

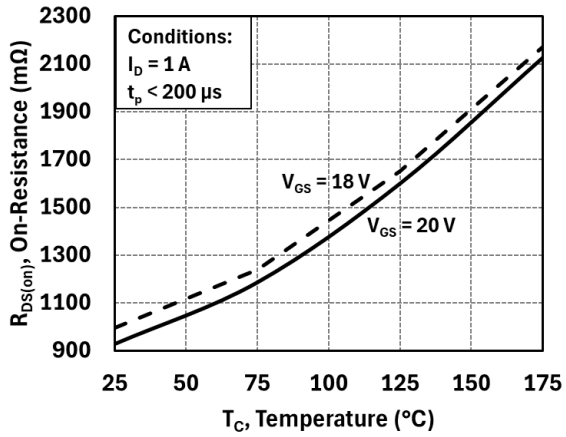


Figure 4: On-Resistance vs. Temperature

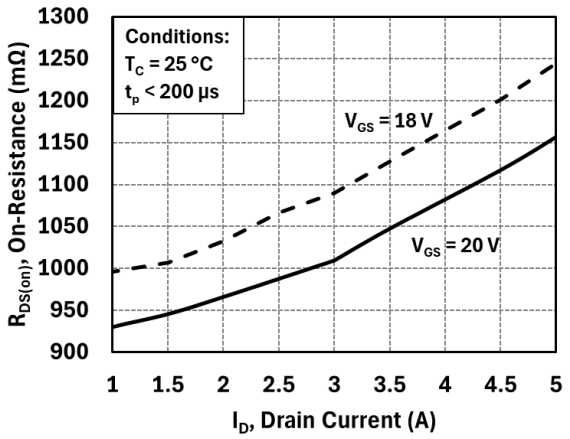


Figure 5: On-Resistance vs. Drain Current

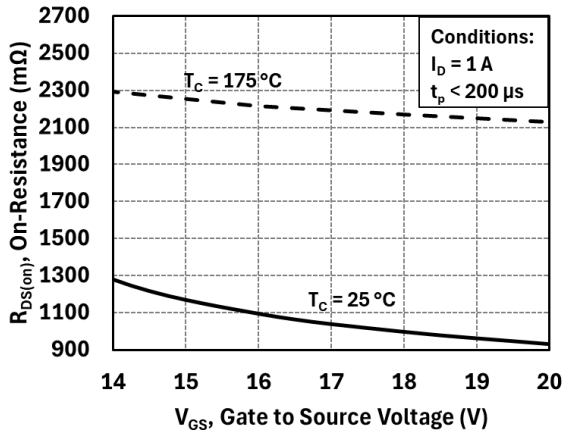


Figure 6: On-Resistance vs. Gate Voltage

Typical Performance

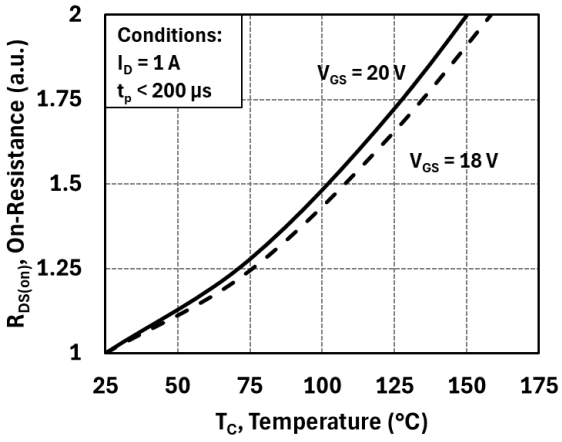


Figure 7: Normalized On-Resistance vs. Temperature

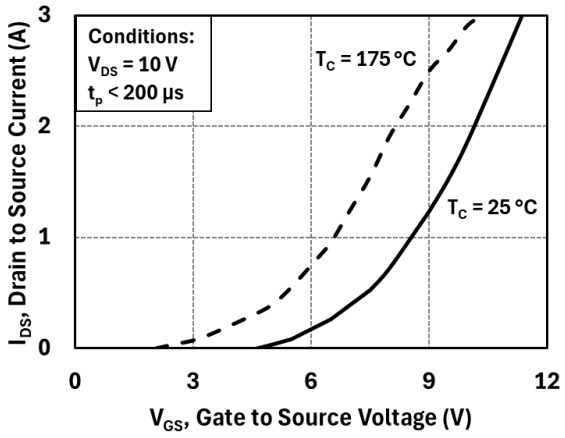


Figure 8: Transfer Characteristics

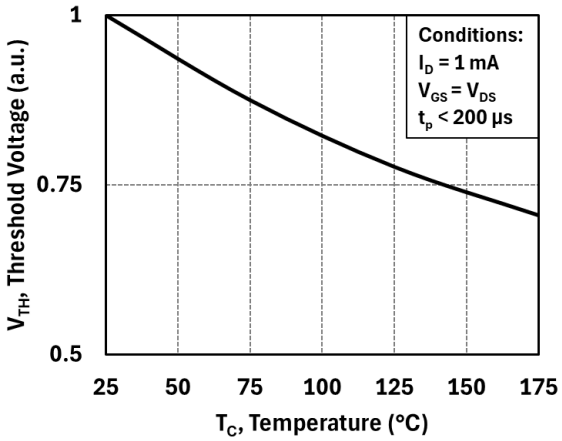


Figure 9: Threshold Voltage vs. Temperature

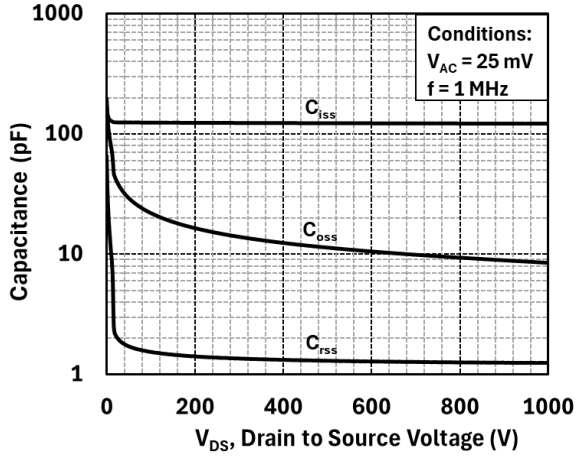


Figure 10: Capacitances vs. Drain-Source Voltage (0-1000 V)

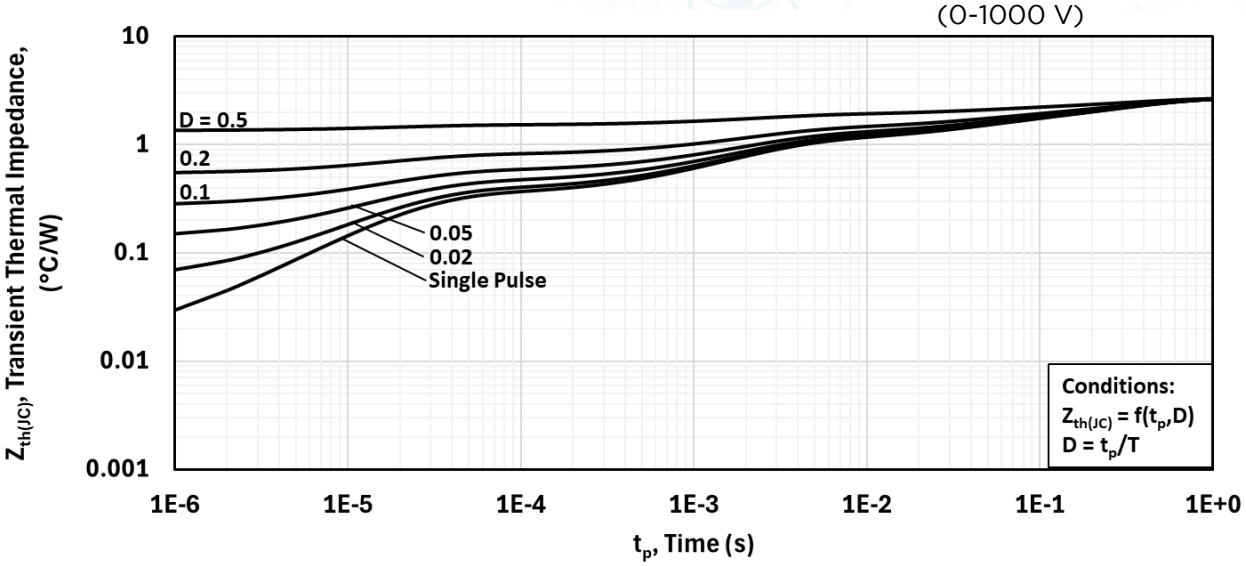


Figure 11: Transient Thermal Impedance

Typical Performance

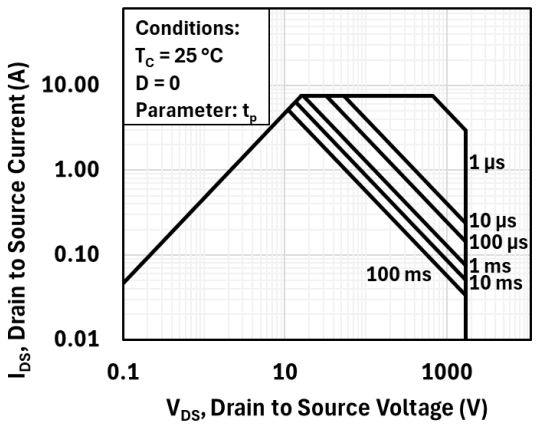


Figure 12: Safe Operating Area

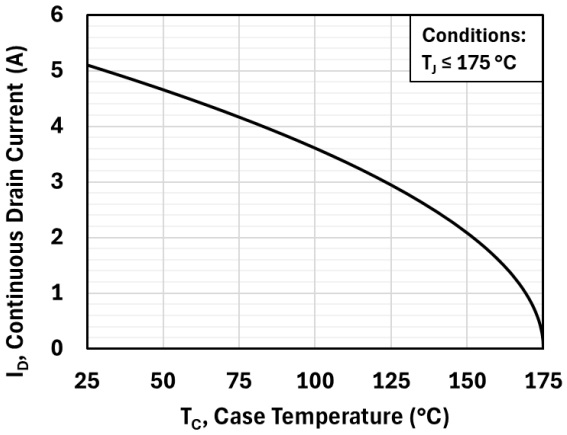


Figure 13: Current De-rating Curve

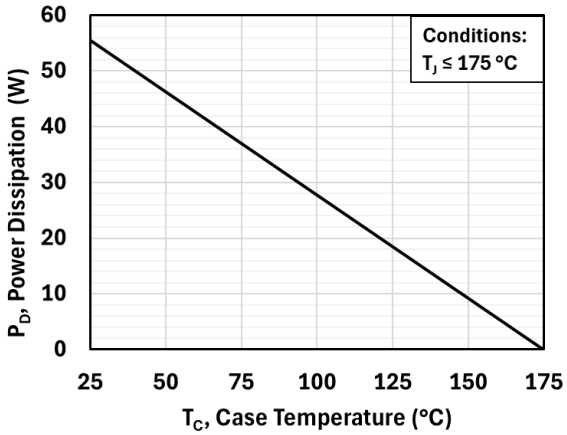


Figure 14: Power De-rating Curve

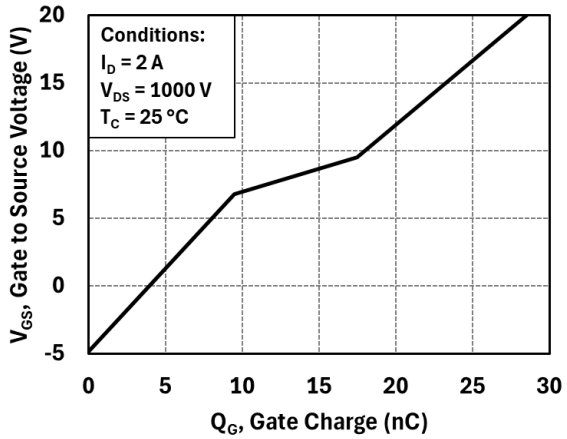


Figure 15: Gate Charge Characteristics

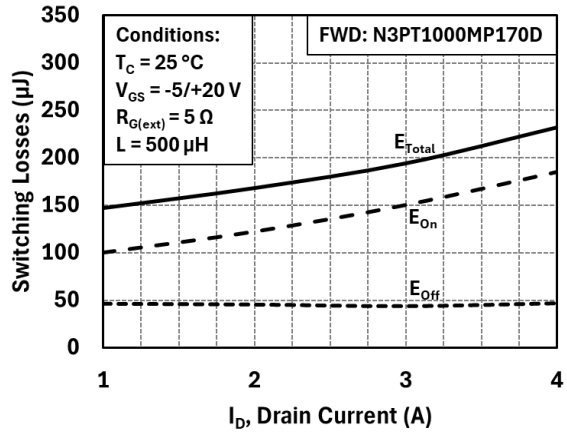


Figure 16: Inductive Switching Energy vs. Drain Current (V_{DD} = 1200 V)

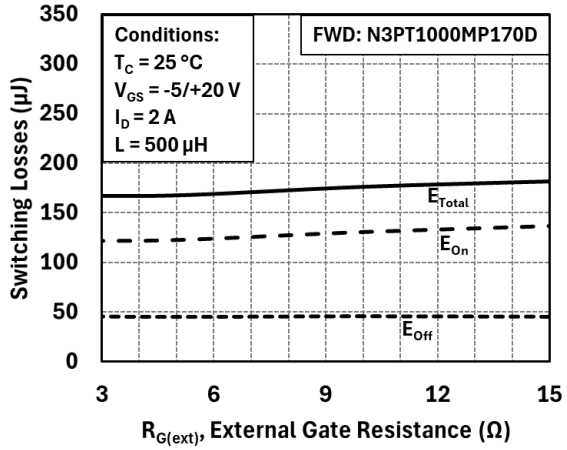


Figure 17: Inductive Switching Energy vs. $R_{G(ext)}$ (V_{DD} = 1200 V)

Typical Performance

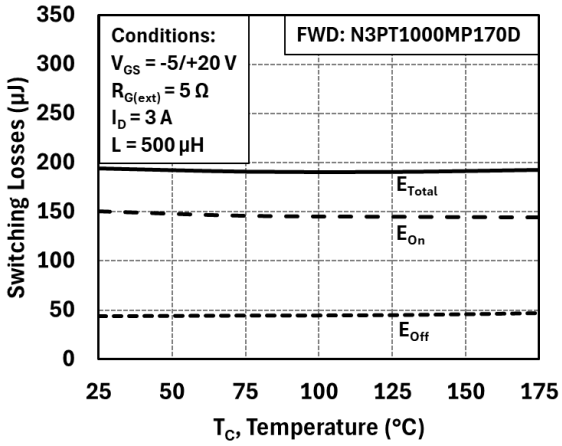


Figure 18: Inductive Switching Energy vs. Temperature (V_{DD} = 1200 V)

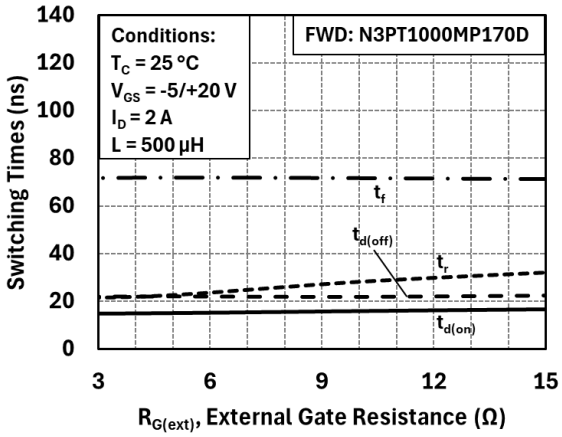


Figure 19: Switching Times vs. $R_{G(ext)}$ (V_{DD} = 1200 V)

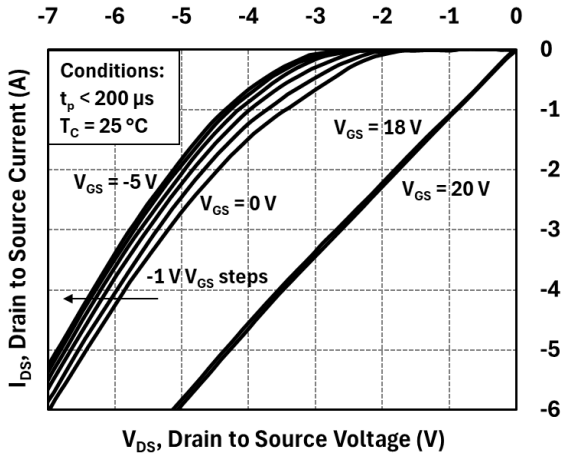


Figure 20: Body Diode Characteristics at 25 °C

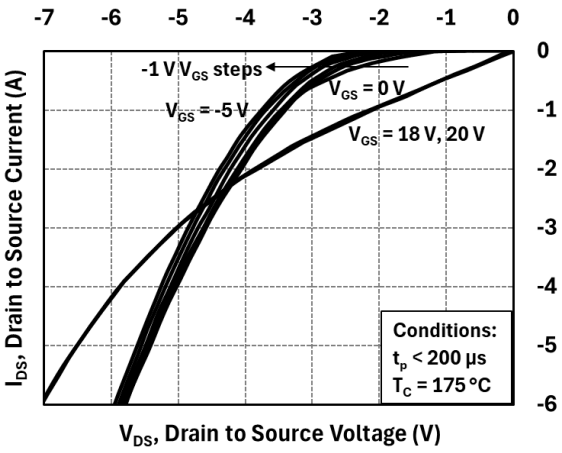


Figure 21: Body Diode Characteristics at 175 °C

Dynamic Testing Circuit Schematics

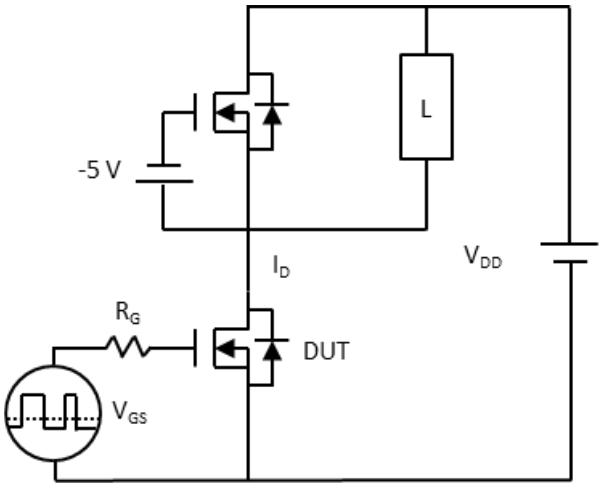


Figure 22: Inductive Load Switching Test Circuit

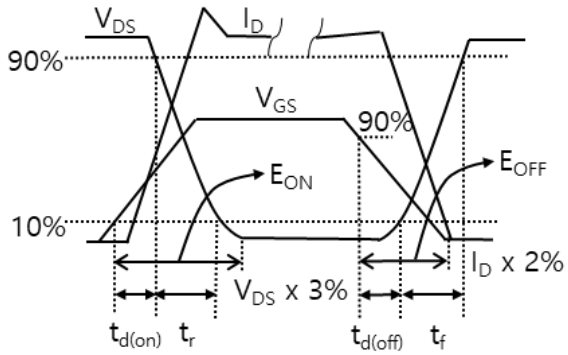


Figure 23: Inductive Load Switching Test Waveforms

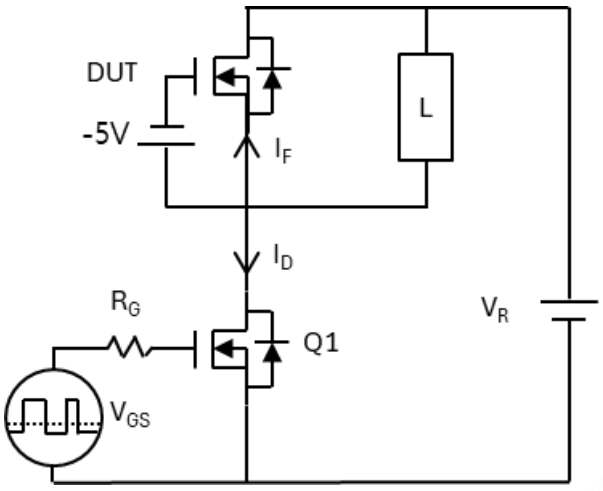


Figure 24: Reverse Recovery Test Circuit

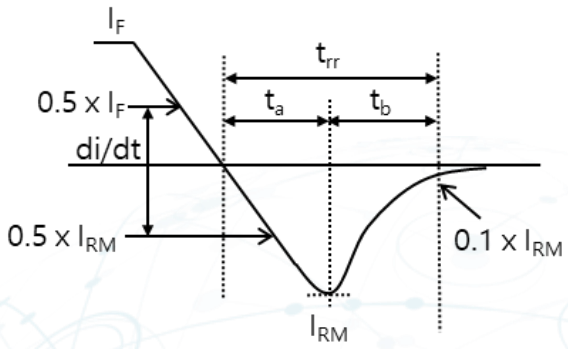


Figure 25: Body Diode Reverse Recovery Test Waveforms

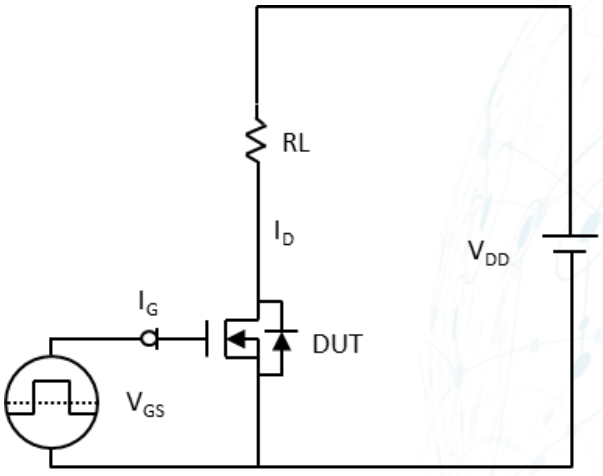


Figure 26: Gate Charge Test Circuit

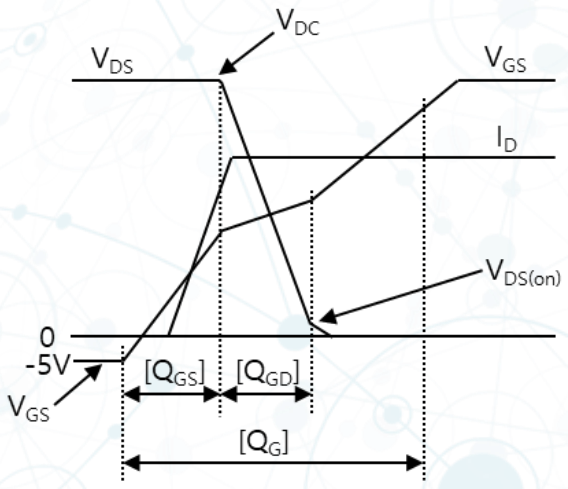
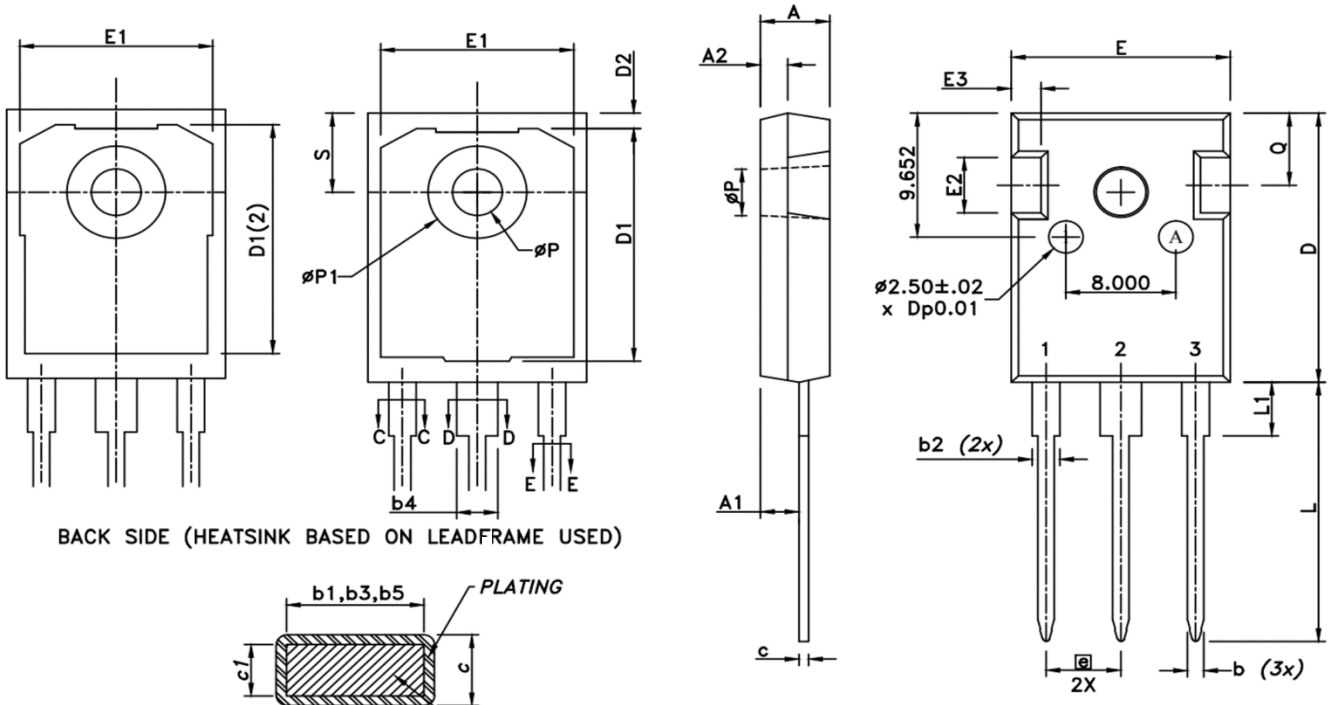


Figure 27: Gate Charge Test Waveforms

Package Dimensions



AREA	MIN	NOM	MAX
A	4.902	5.029	5.156
A1	2.253	2.380	2.507
A2	1.854	1.981	2.108
D	20.828	20.955	21.082
E	15.773	15.900	16.027
E2	4.191	4.318	4.445
E3	2.100	2.356	2.613
e	5.385	5.436	5.487
L	20.066	20.193	20.320
L1	3.937	4.191	4.445
øP	3.556	*3.607*	3.658
Q	5.486	5.613	5.740
S	6.045	6.172	6.299
b	0.991	–	1.397
b1	0.991	1.199	1.346
b2	1.651	–	2.387
b3	1.651	1.999	2.336
b4	2.591	–	3.429
b5	2.591	3.000	3.378
c	0.381	0.635	0.889
c1	0.381	0.610	0.838
D1	17.187	17.314	17.441
D1(2)	16.881	17.008	17.135
D2	1.067	1.194	1.321
E1	13.894	14.021	14.148
øP1	7.061	7.188	7.315

NOTES:

1. DIMENSIONS ARE IN MILLIMETERS
2. DIMENSION D & E DO NOT INLCUDE MOLD FLASH, MOLD FLASH SHALL NOT EXCEED 0.127 MM PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREME OF THE PLASTIC BODY.
3. øP TO HAVE A MAXIMUM DRAFT ANGLE OF 1.5° TO THE TOP OF THE PART WITH A MAXIMUM HOLE DIAMETER OF 0.154".
4. ACTUAL DIMENSIONS OF E2 AND E3 ARE CLOSED TO MINIMUM SPECIFICATIONS.
5. 'E3 IS NON–COMPLIANT WITH JEDEC.

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