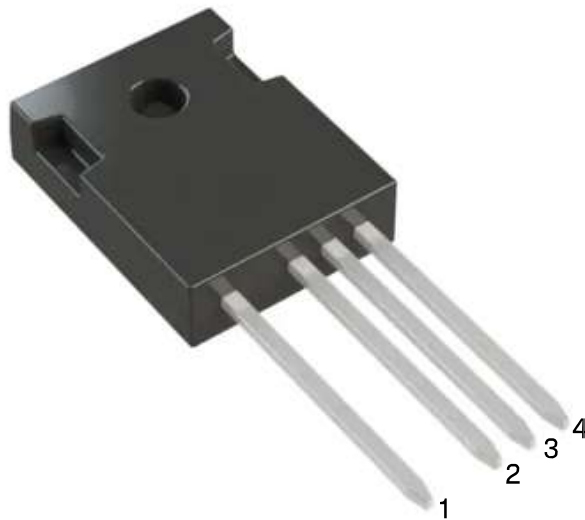


1200 V SIC MOSFET

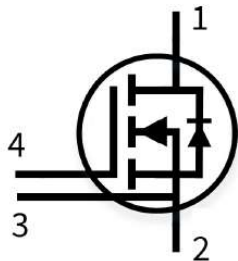
TM3B0020120

Coherent Silicon Carbide power MOSFET offers improved efficiency, higher switching frequency and industry-first 200 °C rating.



FEATURES

- High voltage and low $R_{DS(ON)}$ up to 200°C
- Fast switching enabled by ultra low gate resistance
- Very low, temperature invariant switching losses
- Avalanche ruggedness superior to silicon
- Fast recovery body diode for synchronous rectification



- $V_{DSS} = 1200 \text{ V}$
- $R_{DS(ON)} = 20 \text{ m}\Omega$
- $T_{J,max} = 200^\circ\text{C}$

MOSFET DC Characteristics @ $T_J=25^\circ\text{C}$ (unless otherwise specified)

Symbols	Parameters	Conditions	Min.	Typ.	Max.	Unit
I_D	Continuous Drain Current	$V_{GS} = 20\text{ V}, T_C = 25^\circ\text{C}$			108	A
		$V_{GS} = 20\text{ V}, T_C = 100^\circ\text{C}$			82	
		$V_{GS} = 20\text{ V}, T_C = 125^\circ\text{C}$			71	
$I_{D,pulse}$	Pulsed Drain Current ¹⁾	$T_C = 25^\circ\text{C}$			120	
P_{tot}	Power Dissipation	$T_C = 25^\circ\text{C}$			473	W
$V_{(BR)DSS}$	Drain - Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_{DS} = 20\text{ }\mu\text{A}$	1200			V
I_{DSS}	Drain Leakage Current	$V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}, T_J = 25^\circ\text{C}$			20	μA
		$T_J = 200^\circ\text{C}$			200	
I_{GSS}	Gate-Source Leakage Current	$V_{GS} = -15/+23\text{ V}$			100	nA
V_{GS}	Recommended Gate-source Voltage			20		V
$V_{GS, max}$	Maximum Gate-source Voltage	$V_{DS}=0\text{ V}$			-15/+23	
V_{TH}	Gate-source Threshold Voltage	$V_{GS} = V_{DS}, I_{DS} = 20\text{ mA}$	2.0	2.8	4.0	
$R_{DS(on)}$	Drain-source on-resistance	$V_{GS} = 20\text{ V}, I_{DS} = 65\text{ A}, T_J = 25^\circ\text{C}$		20	28	m Ω
		$T_J = 200^\circ\text{C}$		40	50	
$R_{GATE, ESR}$	Gate-source Series Resistance	$V_{GS} = 0\text{ V}, \text{ drain source shorted}$		0.75		Ω
E_{AS}	Single Pulse Avalanche Energy	$I_D = 30\text{ A}, L = 6.7\text{ mH}$		3.5		J
R_{thJC}	Thermal Resistance, Junction-Case	Assumes TO247-packaged die		0.34		$^\circ\text{C/W}$
T_J, T_{stg}	Operating Junction and Storage Temperature		-55		200	$^\circ\text{C}$

MOSFET Dynamic Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Units
C_{ISS}	Input capacitance	$V_{GS} = 0 \text{ V}, V_{DS} = 500 \text{ V}, f = 100 \text{ kHz}$		4220		pF
C_{OSS}	Output capacitance			198		
C_{RSS}	Reverse transfer capacitance			15		
$t_{d(on)}$	Turn-on delay time	$V_{DS} = 600 \text{ V}, V_{GS} = 0/20 \text{ V}, I_D = 40 \text{ A}, R_{G,ext} = 5.6 \Omega$		13		ns
t_r	Rise time			12		
$t_{d(off)}$	Turn-off delay time			50		
t_f	Fall time			15		
E_{ON}	Turn-on energy	$V_{DS} = 600 \text{ V}, V_{GS} = 0/20 \text{ V}, I_D = 70 \text{ A}, R_{G,ext} = 5.6 \Omega, L = 1.6 \text{ mH}, \text{FWD} = \text{C4D10120}$		0.57		mJ
E_{OFF}	Turn-off energy			0.26		
E_{TOT}	Total switching energy			0.83		
Q_G	Total gate charge	$V_{GS} = 0 \text{ to } 18 \text{ V}, I_{DS} = 30 \text{ A}, V_{DS} = 900 \text{ V}$		154		nC
Q_{GS}	Gate-source charge			28		
Q_{GD}	Gate-drain charge			62		

Diode Characteristics ²⁾

Symbol	Parameter	Conditions	Min	Typ	Max	Units
I_{SD}	Pulsed body diode current	$V_{GS} = 0 \text{ V}$			100	A
V_{SD}	Diode forward voltage	$V_{GS} = 0 \text{ V}, I_{SD} = 65 \text{ A}$		3.9		V

¹⁾ Pulse width limited by $T_{J,max}$.

²⁾ We recommend the use of body diode in synchronous rectification mode with repetitive conduction during switch commutation dead-time $\leq 1 \mu\text{s}$. Our long term (up to 13,000 hours) continuous switching test results show excellent reliability and forward voltage stability, indicating it is safe to use the body diode in this mode.

Figure 1. Output Characteristics
 $I_D = f(V_{DS}, V_{GS}); T_J = 25^\circ\text{C}$

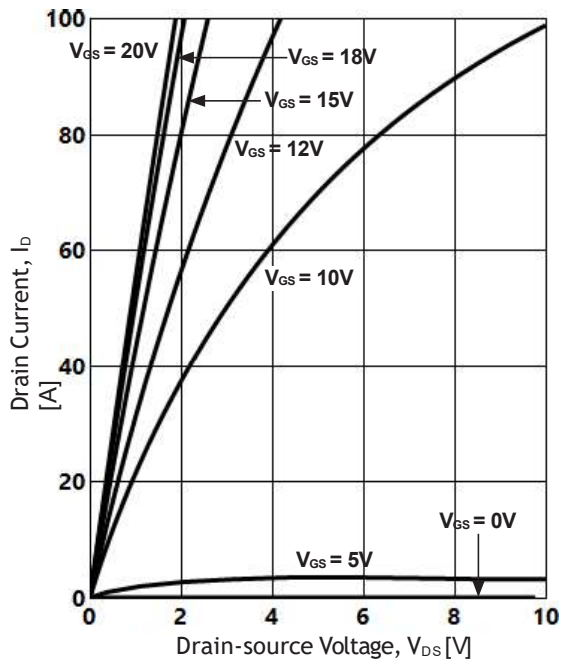


Figure 2. Output Characteristics
 $I_D = f(V_{DS}, V_{GS}); T_J = 200^\circ\text{C}$

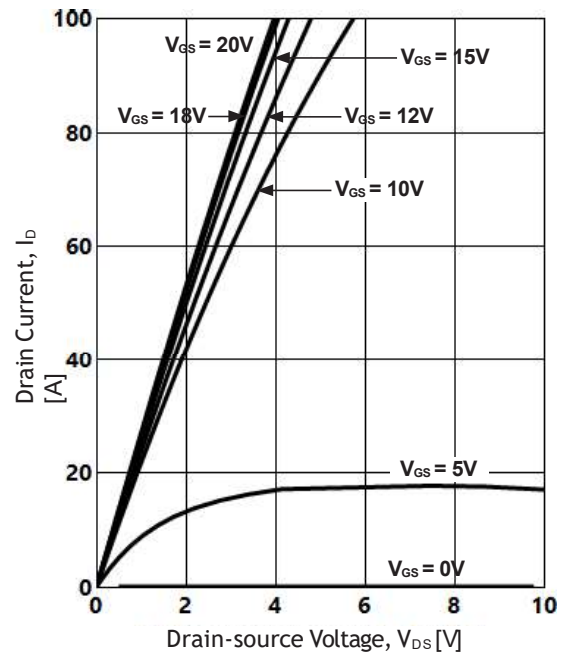


Figure 3. Threshold Voltage
 $V_t = f(T_J); V_{DS} = V_{GS}; I_D = 20 \text{ mA}$

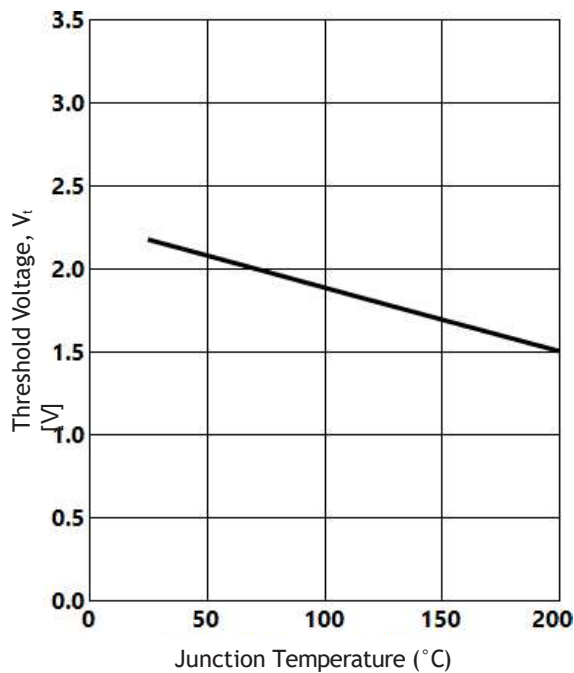


Figure 4. Drain-source On-state Resistance
 $R_{DS(on)} = f(T_J); I_D = 65 \text{ A}$

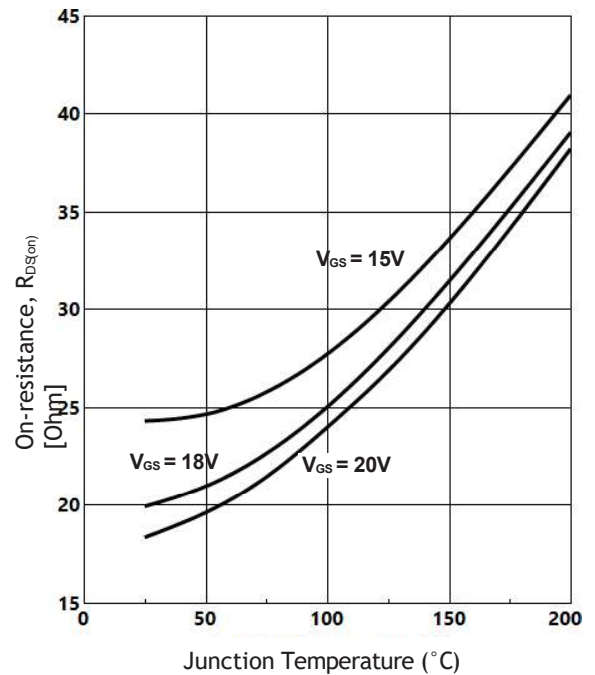


Figure 5. Drain-source On-state Resistance

$$R_{DS(on)} = f(I_D); T_J = 25^\circ\text{C}$$

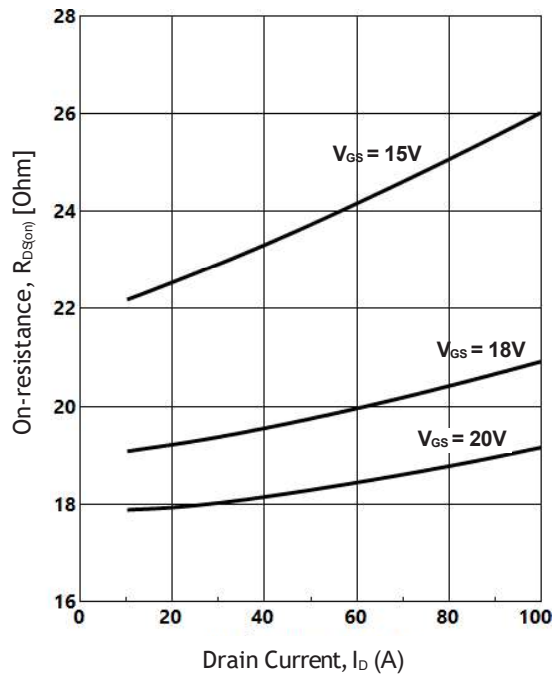


Figure 6. Drain-source On-state Resistance

$$R_{DS(on)} = f(T_J); V_{GS} = 20V$$

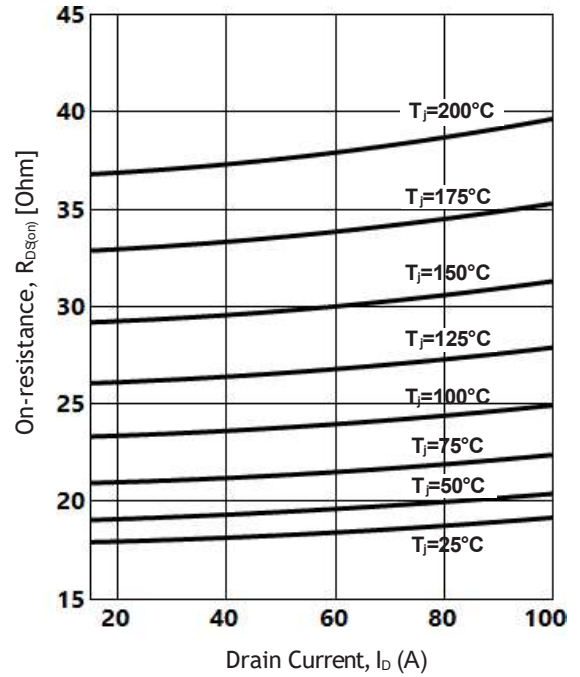


Figure 7. Third Quadrant Characteristics

$$I_D = f(V_{DS}, V_{GS}); T_J = 25^\circ\text{C}$$

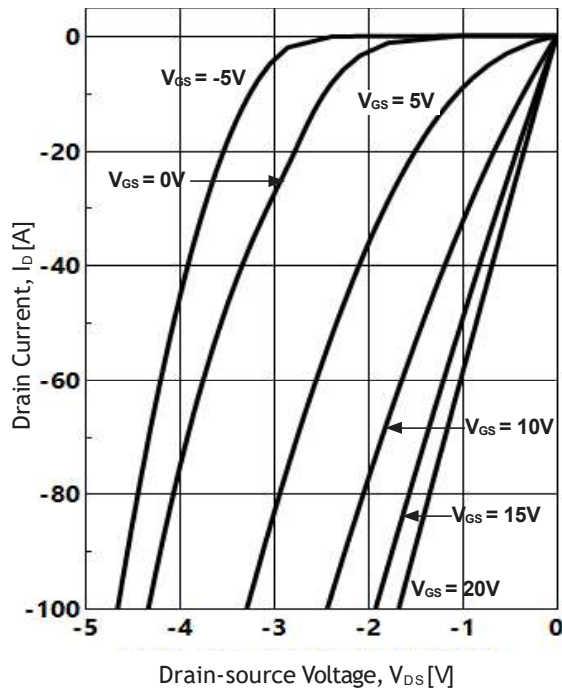


Figure 8. Third Quadrant Characteristics

$$I_D = f(V_{DS}, V_{GS}); T_J = 200^\circ\text{C}$$

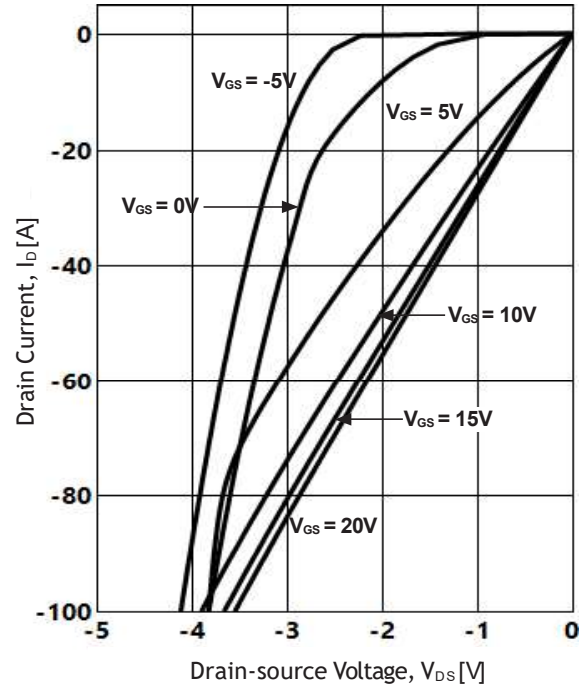


Figure 9. Capacitances
 $C = f(V_{DS}); f = 100 \text{ kHz}$

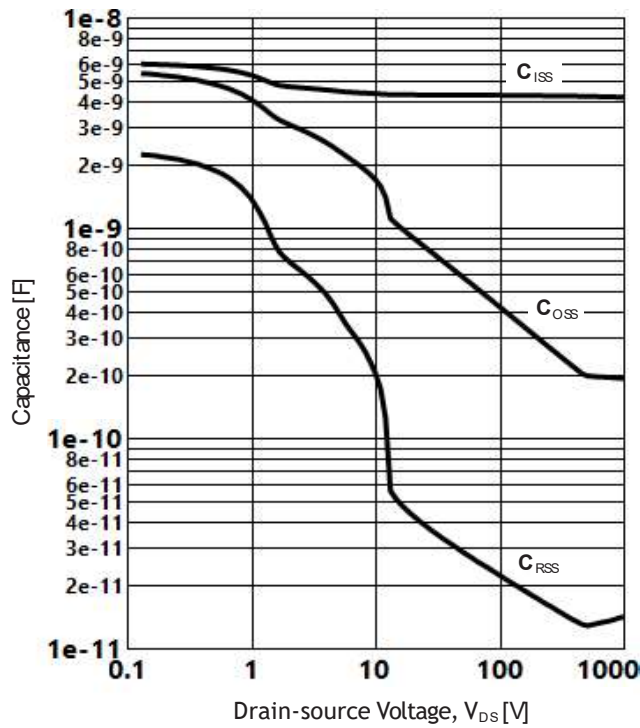


Figure 10. Clamped Inductive Switching Energy
 $E_{ON} = f(I_D); E_{OFF} = f(I_D); E_{TOT,SW} = f(I_D)$

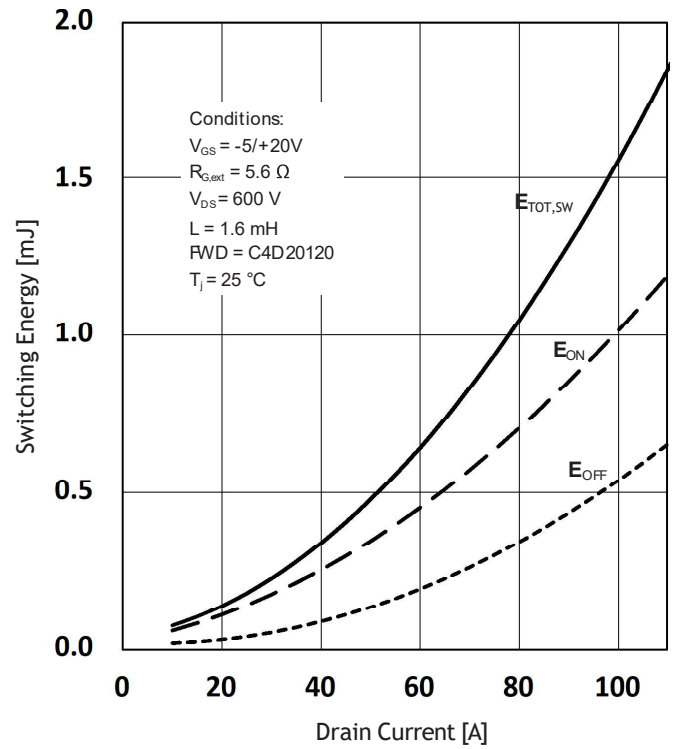


Figure 11. Typical Unclamped Inductive Switching Waveforms
 $I_D = f(t); V_{DS} = f(t)$

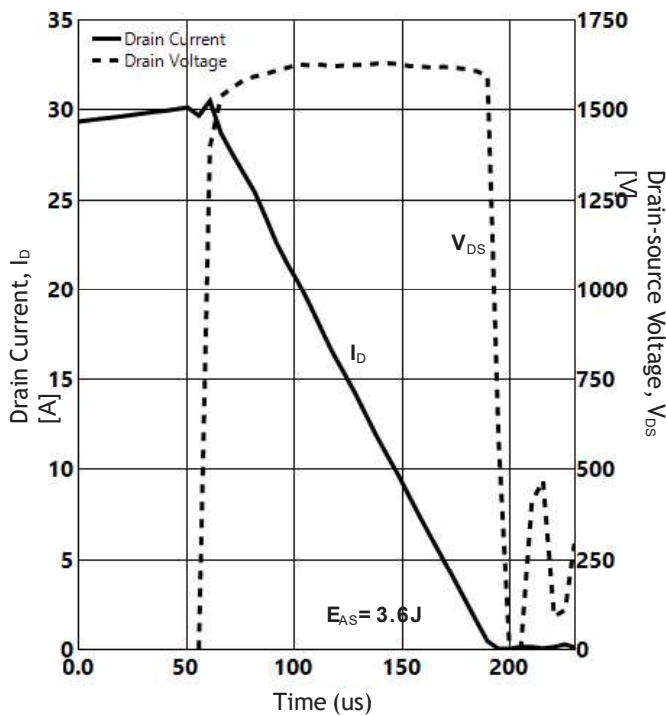


Figure 12. Third Quadrant Characteristics
 $I_D = f(V_{DS}, V_{GS}); T_J = 200^\circ C$

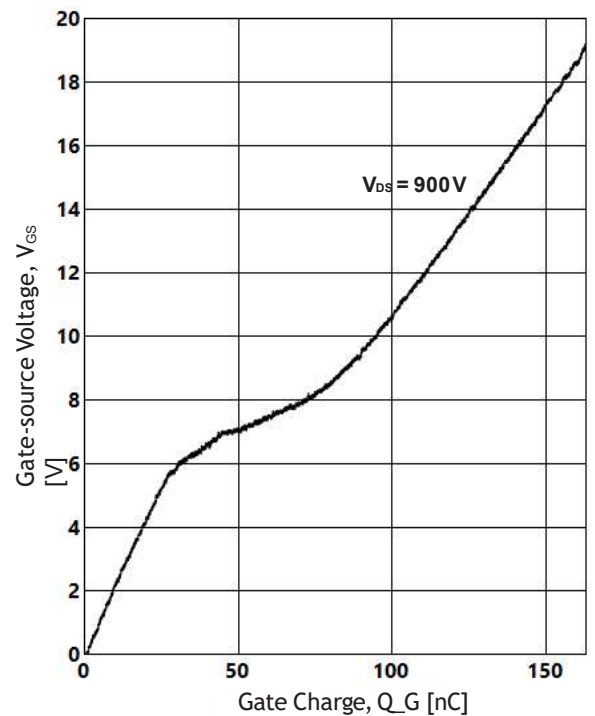


Figure 13. Transfer Characteristic
 $I_D = f(V_{GS})$; $V_{DS} = 10\text{ V}$; $T_j = 25^\circ\text{C}$

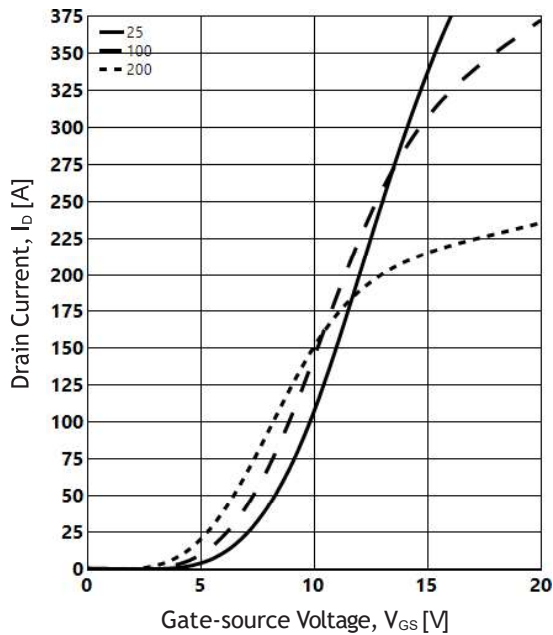


Figure 14. Clamped Inductive Switching
Waveform Test Circuit

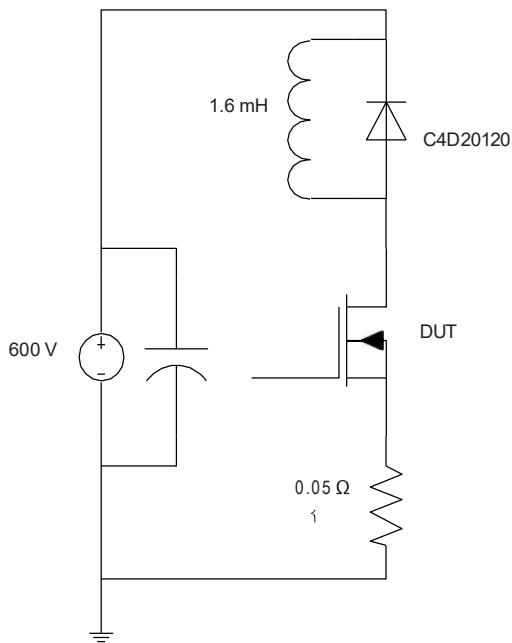


Figure 15. Switching Waveforms for Transition Times

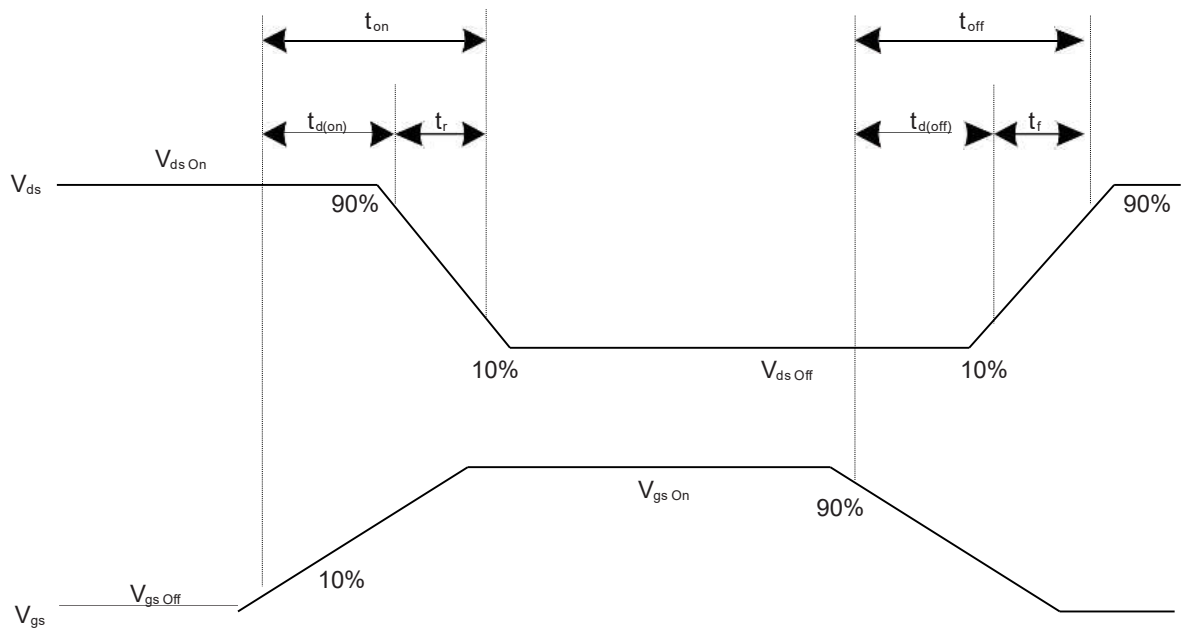
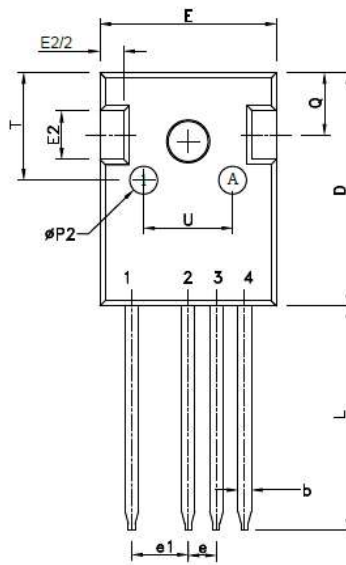
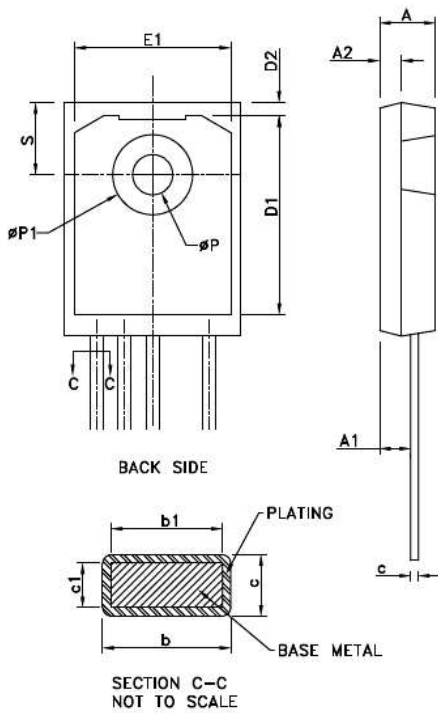


Figure 16. Part Dimensions in mm ⁵⁾



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	14.318	4.772	5.225
E2/2	2.159	2.386	2.613
e	2.515	2.540	2.565
e1	4.980	5.080	2.518
L	19.812	20.193	20.320
P	3.556	3.607	3.658
Q	5.486	5.613	5.740
S	6.15 BSC		
b	1.070	—	1.330
b1	0.991	1.199	1.346
c	0.550	0.615	0.680
c1	0.381	0.610	0.838
D1	16.250	16.550	16.850
D2	1.067	1.194	1.321
E1	13.894	14.021	14.148
P1	—	—	7.40
P2	2.40	2.50	2.60
T	9.40	9.60	9.80
U	7.80	8.00	8.20

NOTES:

1. DIMENSIONS ARE IN MILLIMETERS
2. DIMENSION D & E DO NOT INCLUDE 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. P TO HAVE A MAXIMUM DRAFT ANGLE OF 1.5° TO THE TOP OF THE PART WITH A MAXIMUM HOLE DIAMETER OF 3.91 MM."
4. EJECTION MARK DEPTH 0.1025 ± 0.005
5. ACTUAL DIMENSIONS OF E2 and E2/2 ARE CLOSED TO MINIMUM SPECIFICATIONS.
6. ACTUAL DIMENSIONS OF b and c ARE CLOSED TO MINIMUM SPECIFICATIONS.

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