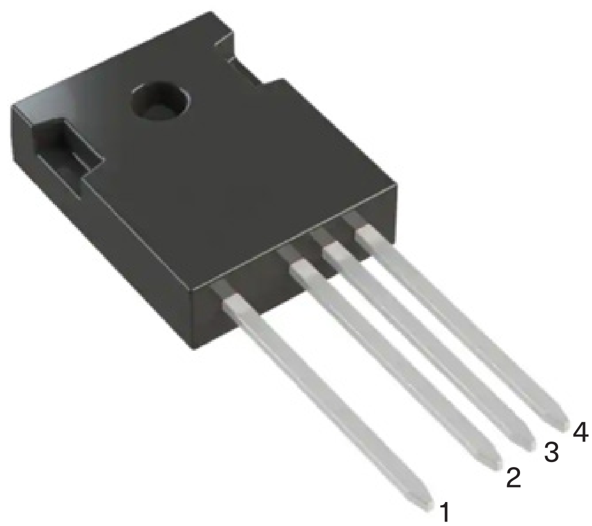
1200 V SIC MOSFET

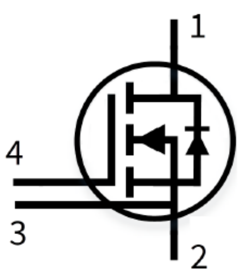
TM3B0020120

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 V
- $R_{DS(ON)}$ = 20 mΩ
- $T_{J,max}$ = 200°C

COHERENT

MOSFET DC Characteristics @ T_J=25°C (unless otherwise specified)

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

MOSFET Dynamic Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Units
C_{ISS}	Input capacitance	V_{GS} = 0 V, V_{DS} = 500 V, f = 100 kHz		4220		pF
C_{OSS}	Output capacitance			198		
C_{RSS}	Reverse transfer capacitance			15		
$t_{d(on)}$	Turn-on delay time	V_{DS} = 600 V, V_{GS} = 0/20 V, I_D = 40 A, $R_{G,ext}$ = 5.6 Ω		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 V, V_{GS} = 0/20 V, I_D = 70 A, $R_{G,ext}$ = 5.6 Ω, L = 1.6 mH, FWD = 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 to 18 V, I_{DS} = 30 A, V_{DS} = 900 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 V			100	A
V_{SD}	Diode forward voltage	V_{GS} = 0 V, I_{SD} = 65 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 ≤ 1 µs. 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
$I_D = f(V_{DS}, V_{GS})$; $T_j = 25°C$

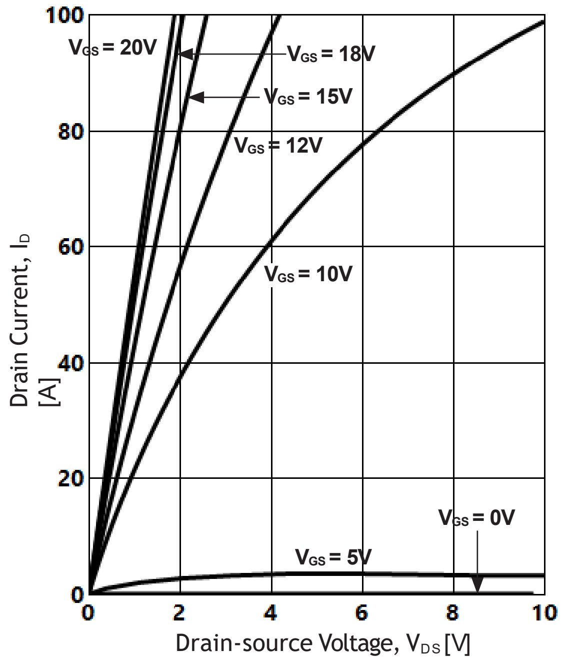


Figure 2. Output Characteristics
$I_D = f(V_{DS}, V_{GS})$; $T_j = 200°C$

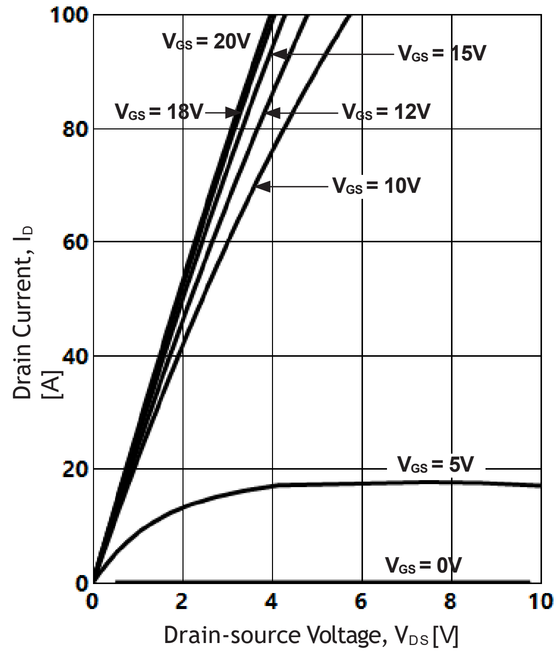


Figure 3. Threshold Voltage
$V_t = f(T_j)$; $V_{DS} = V_{GS}$; $I_D = 20$ mA

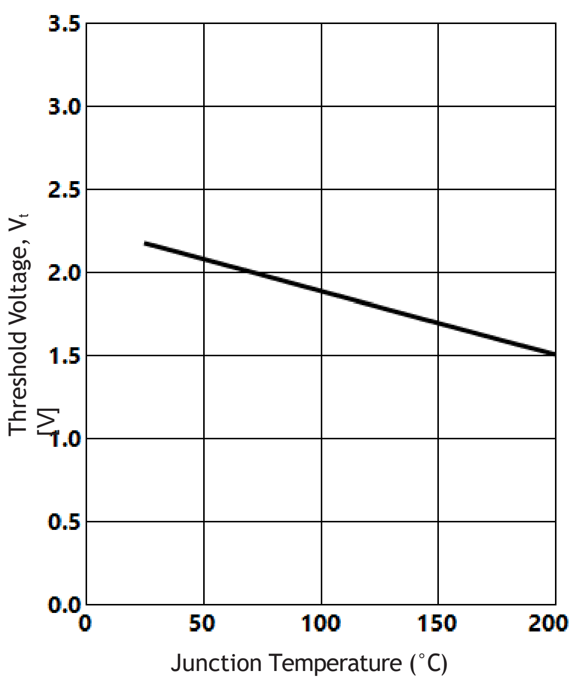


Figure 4. Drain-source On-state Resistance
$R_{DS(on)} = f(T_j)$; $I_D = 65$ A

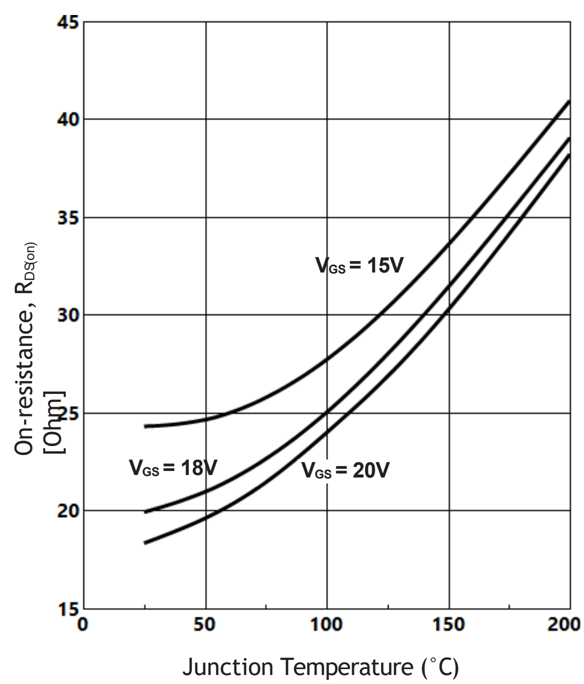


Figure 5. Drain-source On-state Resistance
$R_{DS(on)} = f(I_D)$; $T_j = 25°C$

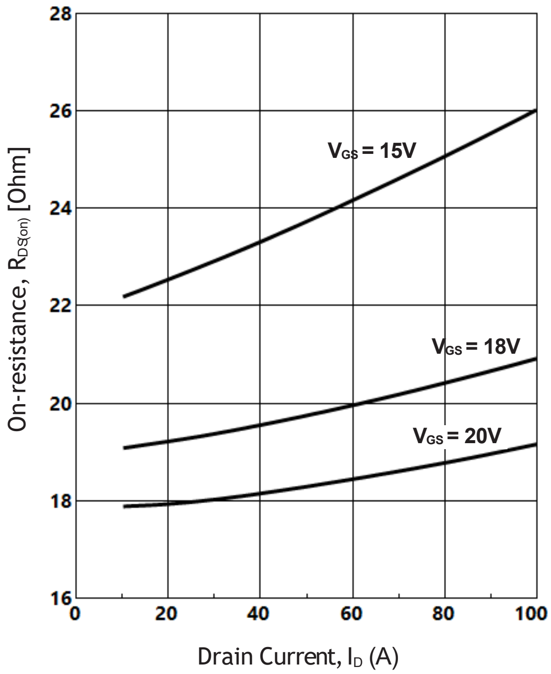


Figure 6. Drain-source On-state Resistance
$R_{DS(on)} = f(T_j)$; $V_{GS} = 20$ V

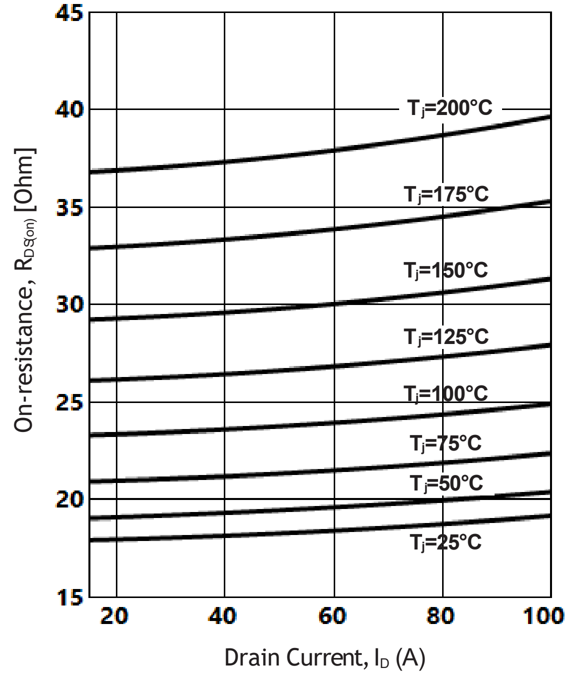


Figure 7. Third Quadrant Characteristics
$I_D = f(V_{DS},V_{GS})$; $T_j = 25°C$

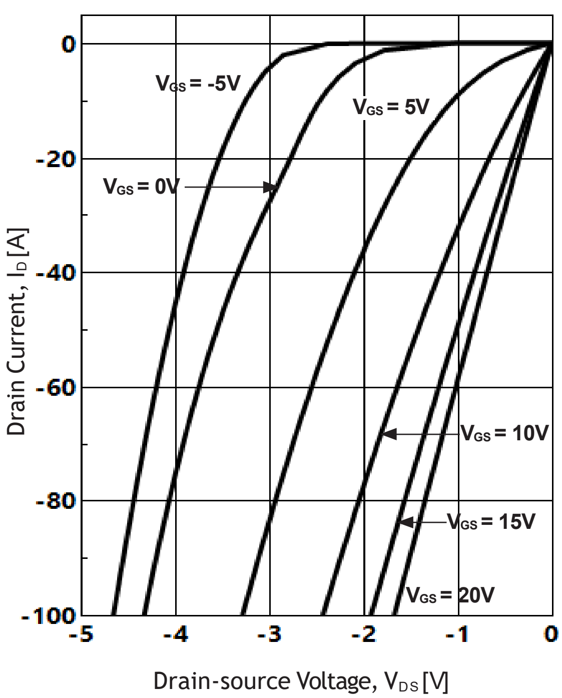


Figure 8. Third Quadrant Characteristics
$I_D = f(V_{DS},V_{GS})$; $T_j = 200°C$

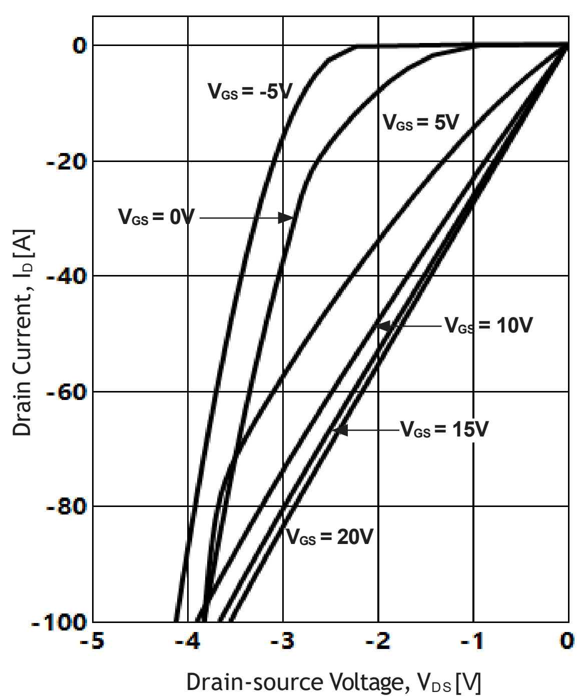


Figure 9. Capacitances
C = f(V_{DS}); f = 100 kHz

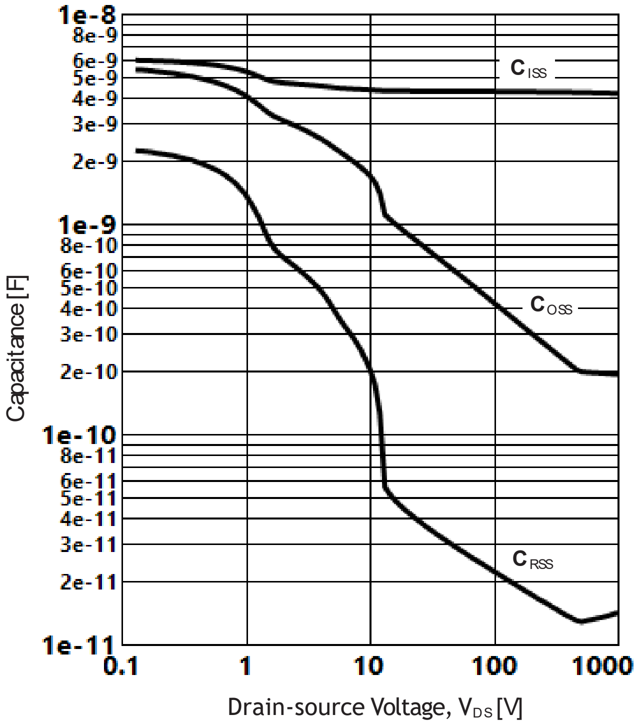


Figure 10. Clamped Inductive Switching Energy
E_{ON} = f(I_D); E_{OFF} = f(I_D); $E_{TOT,SW}$ = f(I_D)

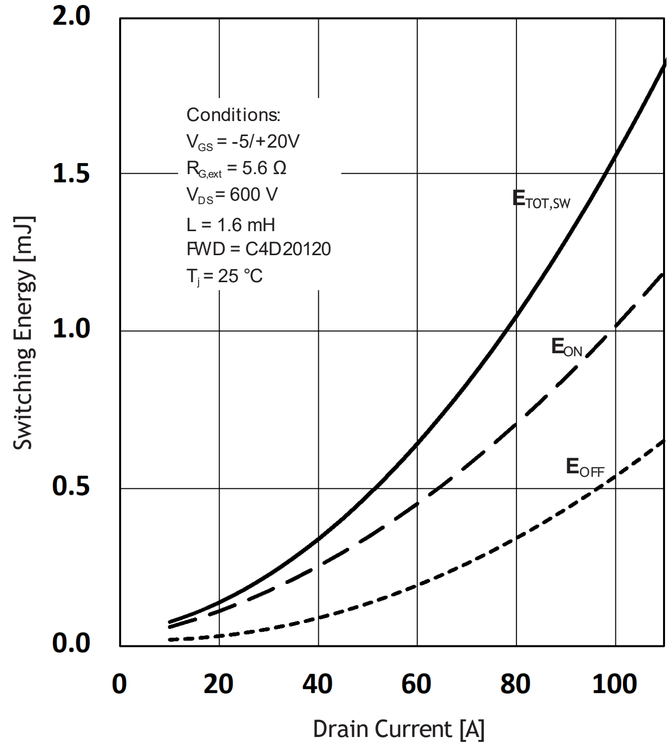


Figure 11. Typical Unclamped Inductive Switching Waveforms
I_D = f(t); V_{DS} = f(t)

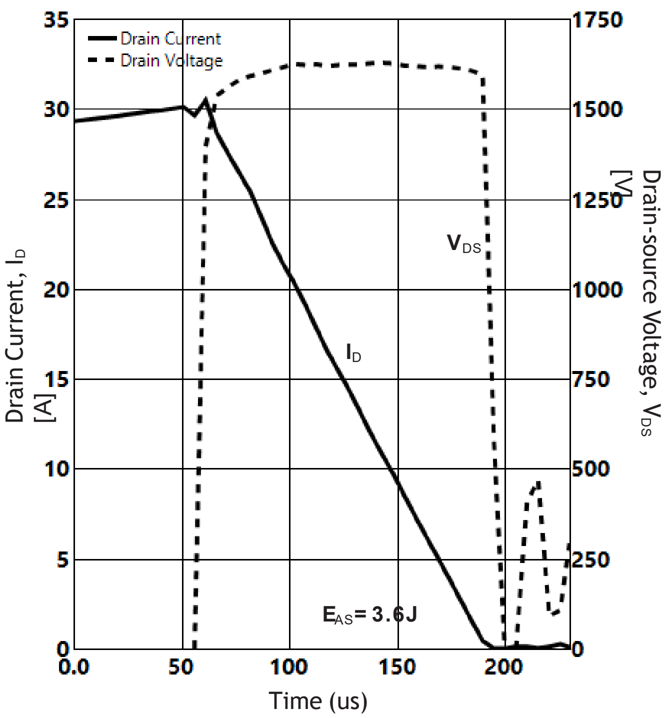


Figure 12. Third Quadrant Characteristics
I_D = f(V_{DS}, V_{GS}); T_J =200 °C

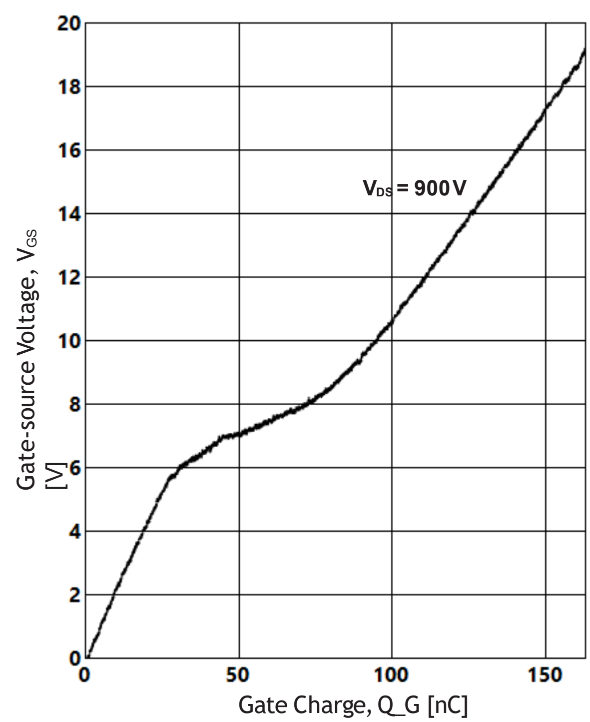


Figure 13. Transfer Characteristic
$I_D = f(V_{GS})$; V_{DS} = 10 V; T_j = 25 °C

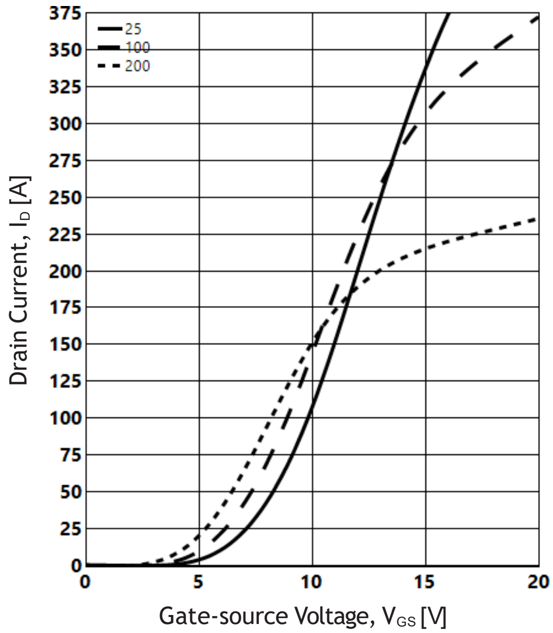


Figure 14. Clamped Inductive Switching Waveform Test Circuit

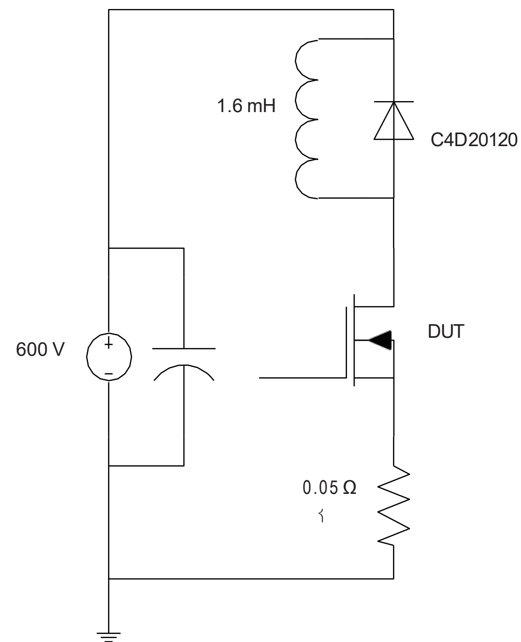


Figure 15. Switching Waveforms for Transition Times

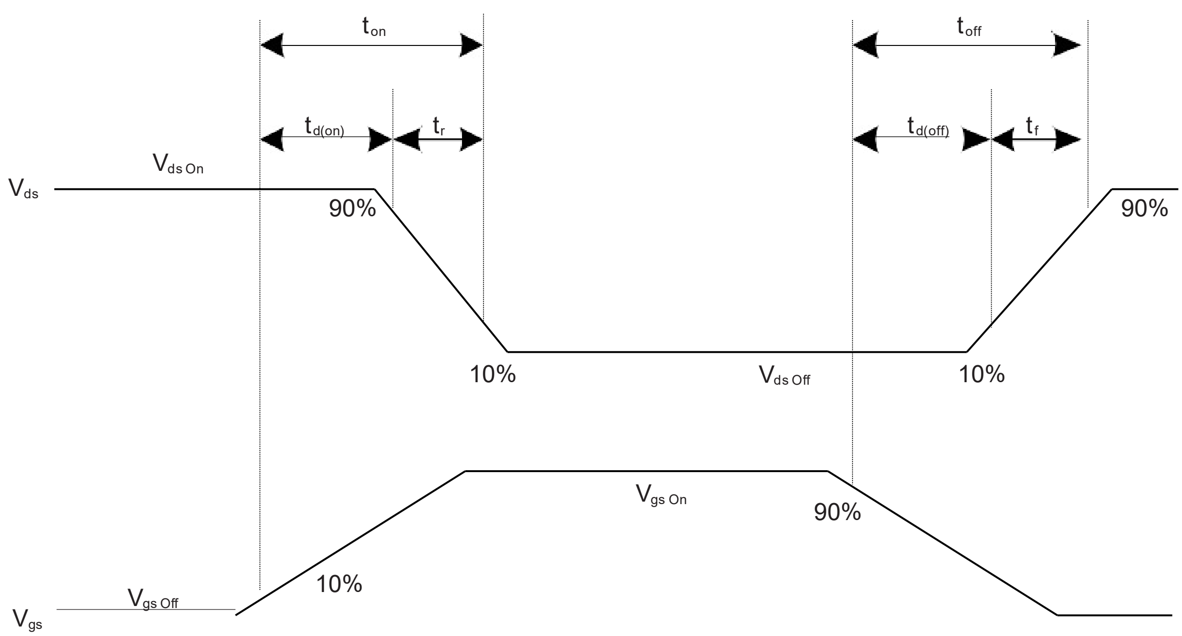
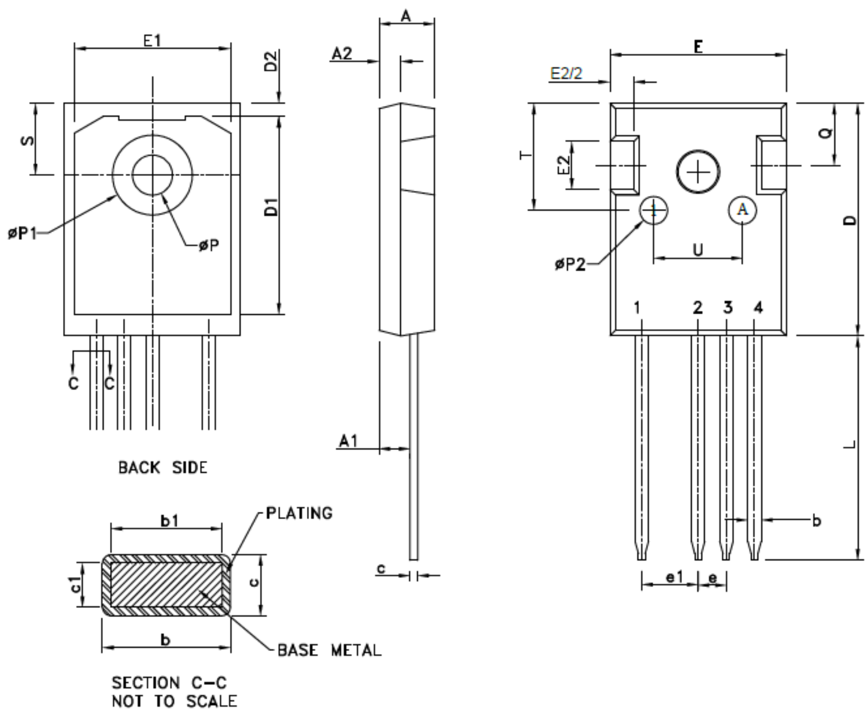


Figure 16. Part Dimensions in mm 5)



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
øP	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
øP1	–	–	7.40
øP2	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 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 3.91 MM."
4. EJECTION MARK DEPTH $0.10^{+0.15}_{-0.05}$
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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