

ICE1000M170W

Silicon Carbide

Power MOSFET

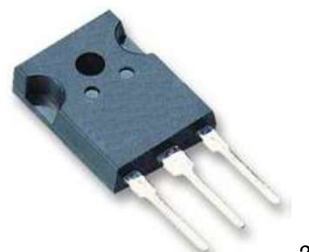
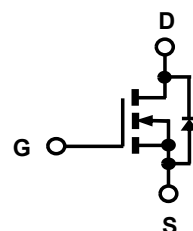
Product Summary			
I_D	$T_A=25^{\circ}\text{C}$	5.6A	Max
$V_{(BR)DSS}$	$T_c=25^{\circ}\text{C}$	1700V	Min
$r_{DS(on)}$	$V_{GS}=18\text{V}$	1000m Ω	Typ
Q_g	$V_{DS}=1200\text{V}$	16.5nC	Typ

Features

- 1700V 1000mohm SiC MOSFET
- High blocking voltage with low on-resistance
- High-speed switching with low capacitances
- Fast Reverse Recovery
- Optimized design for high performance power systems



Lead Free



TO247
1:G, 2:D,
3:S

(TO-247)

Maximum ratings^a, at $T_j=25^{\circ}\text{C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	$T_c=25^{\circ}\text{C}$	5.6	A
		$T_c=100^{\circ}\text{C}$	3.9	
Pulsed drain current	$I_{D, \text{pulse}}$		11	A
Maximum gate source voltage	$V_{GS(max)}$		-10/+22	V
Operational gate source voltage	$V_{GS \text{ op}}$		-6/+18	V
Power dissipation	P_{tot}	$T_c=25^{\circ}\text{C}$	100	W
Storage temperature	T_{stg}		-55 to +175	$^{\circ}\text{C}$
Operating temperature	T_j			

^a Pulse width limited by T_{jmax}

Parameter	Symbol	Conditions	Values			Unit
			Min	Typ	Max	

Thermal characteristics

Thermal resistance, junction-case	R_{thJC}		-	-	1.5	°C/W
Thermal resistance, junction-ambient	R_{thJA}	leaded	-	-	40	
Soldering temperature, wave soldering only allowed at leads	T_{solder}	1.6mm (0.063in.) from case for 10 s	-	-	260	°C

Electrical characteristics^a, at $T_i=25^{\circ}\text{C}$, unless otherwise specified

Static characteristics

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0V, I_D=100\mu A$	1700	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=0.7mA$	1.8	3.2	4	
		$V_{DS}=V_{GS}, I_D=0.7mA, T_j=175^{\circ}\text{C}$	-	2	-	
Zero gate voltage drain current	I_{DSS}	$V_{DS}=1700V, V_{GS}=0V$	-	5	50	μA
Gate source leakage current	I_{GSS}	$V_{GS}=-10/+22V, V_{DS}=0V$	-	-	± 100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=18V, I_D=2A$	-	1000	1500	m Ω
		$V_{GS}=18V, I_D=2A, T_j=175^{\circ}\text{C}$	-	2100	-	
Gate resistance	R_G	$f=1\text{ MHz}, V_{AC}=25mV$	-	8.7	-	Ω

Dynamic characteristics

Input capacitance	C_{iss}	$V_{DS}=1000V, V_{GS}=0V, f=100\text{ kHz}, V_{AC}=25mV$	-	184	-	pF
Output capacitance	C_{oss}		-	12	-	
Reverse transfer capacitance	C_{rss}		-	3	-	
C_{OSS} stored energy	E_{oss}		-	7	-	μJ
Forward transconductance	g_{FS}	$V_{DS}=20V, I_D=2A$	-	2.2	-	S
Turn-on delay time	$t_{d(on)}$	$V_{DS}=1200V, V_{GS}=-6/+18V, I_D=2A, R_G=2.5\Omega$ (External), $L=1000\mu H$	-	5	-	ns
Rise time	t_r		-	8	-	
Turn-off delay time	$t_{d(off)}$		-	6	-	
Fall time	t_f		-	41	-	
Turn-on switching energy	E_{ON}	Diode: Body Diode at $V_{GS}=-4V$	-	45	-	μJ
Turn-off switching energy	E_{OFF}		-	21	-	

Parameter	Symbol	Conditions	Values			Unit
			Min	Typ	Max	

Dynamic characteristics

Turn-on delay time	$t_{d(on)}$	$V_{DS}=1200V, V_{GS}=-6/+18V,$ $I_D=2A, R_G=2.5\Omega$ (External), $L=1000\mu H, T_j=175^\circ C$	-	6	-	ns
Rise time	t_r		-	10	-	
Turn-off delay time	$t_{d(off)}$		-	7	-	
Fall time	t_f		-	48	-	
Turn-on switching energy	E_{ON}	Diode: Body Diode at $V_{GS}=-4V$ $T_j=175^\circ C$	-	58	-	μJ
Turn-off switching energy	E_{OFF}		-	7	-	

Gate Charge Characteristics

Gate to source charge	Q_{gs}	$V_{DS}=1200V, I_D=1A,$ $V_{GS}=-6$ to $+18V$	-	2.5	-	nC
Gate to drain charge	Q_{gd}		-	12	-	
Gate charge total	Q_g		-	16.5	-	

Reverse Diode

Continuous forward current	I_S	$V_{GS}=-4V$	-	-	5.6	A
Diode forward voltage	V_{SD}	$V_{GS}=-4V, I_{SD}=1A$	-	4.5	-	V
		$V_{GS}=-4V, I_{SD}=1A, T_j=175^\circ C$	-	3.8	-	
Reverse recovery time	t_{rr}	$V_{GS}=-4V, V_{RR}=1200V,$ $I_{SD}=2A,$ $dI_F/dt=2350 A/\mu s, T_j=175^\circ C$	-	15	-	ns
Reverse recovery charge	Q_{rr}		-	68	-	nC
Peak reverse recovery current	I_{rm}		-	5	-	A

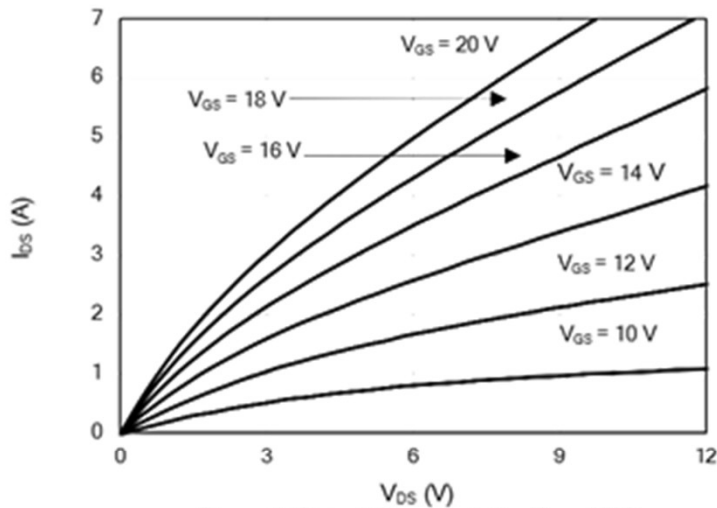


Figure 1: Output Characteristics $T_J = -40^{\circ}\text{C}$

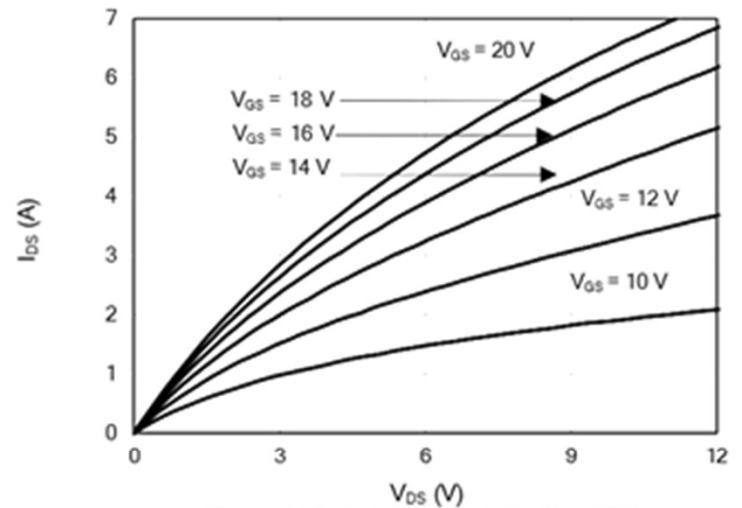


Figure 2: Output Characteristics $T_J = 25^{\circ}\text{C}$

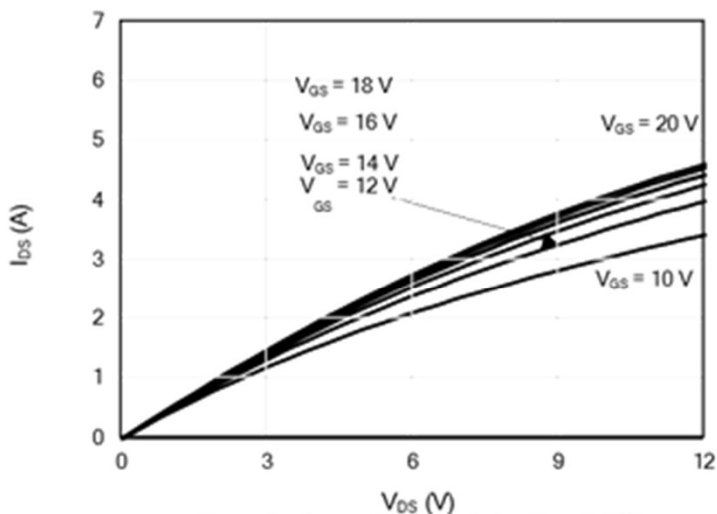


Figure 3: Output Characteristics $T_J = 175^{\circ}\text{C}$

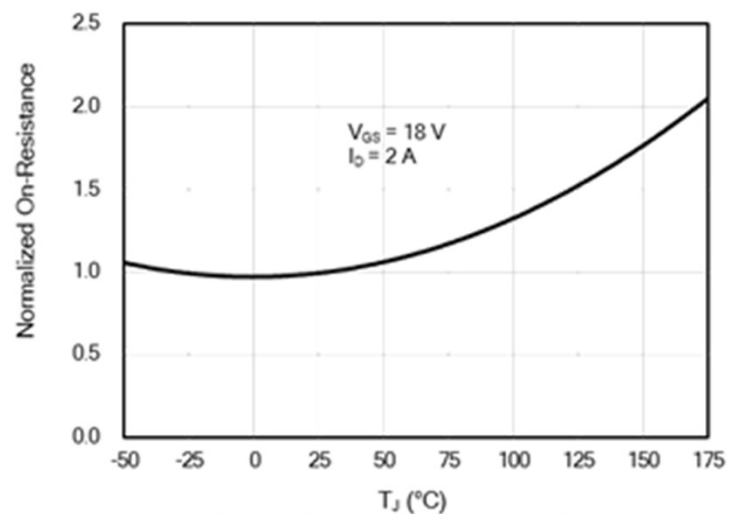


Figure 4: Normalized On-Resistance vs. Temperature

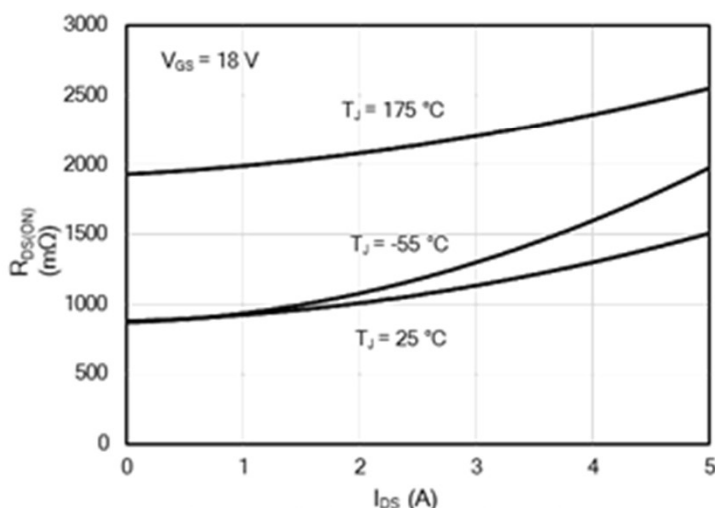


Figure 5: On-Resistance vs. Drain Current
For Various Temperatures

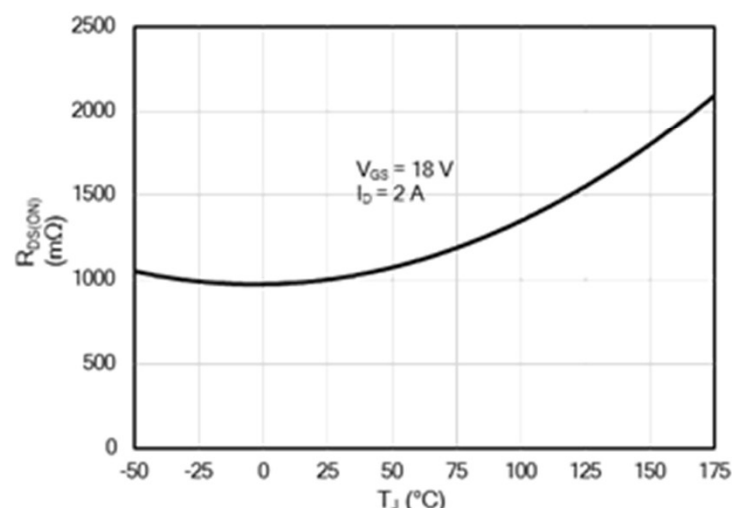


Figure 6: On-Resistance vs. Temperature
For Various Gate Voltage

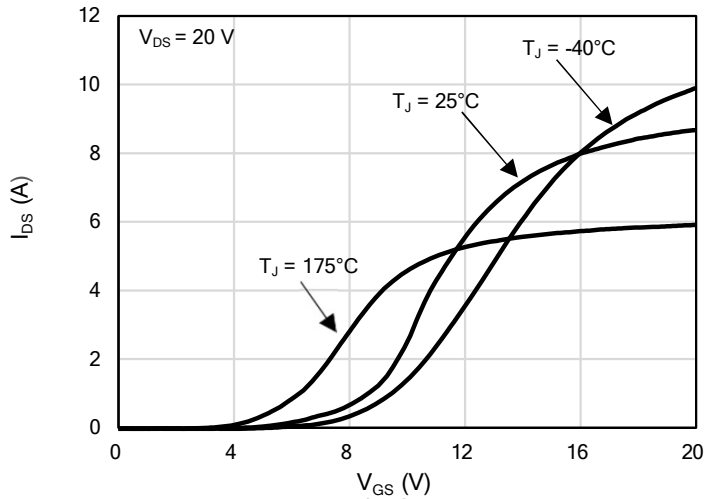


Figure 7: Transfer Characteristics For Various Junction Temperature

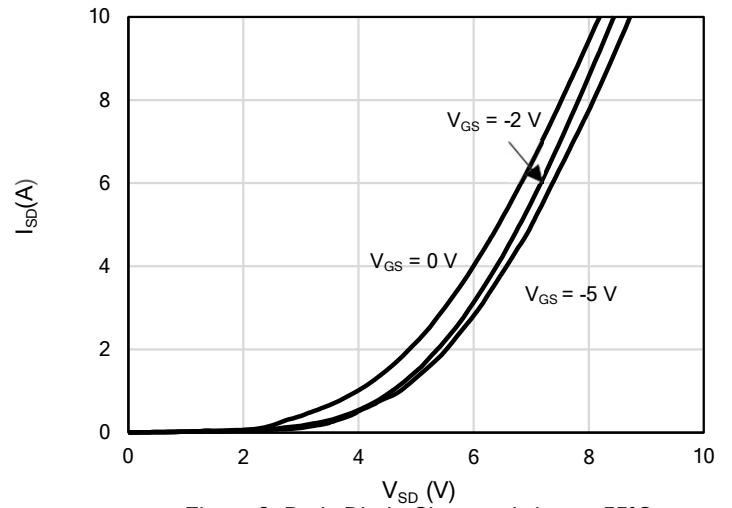


Figure 8: Body Diode Characteristics at -55°C

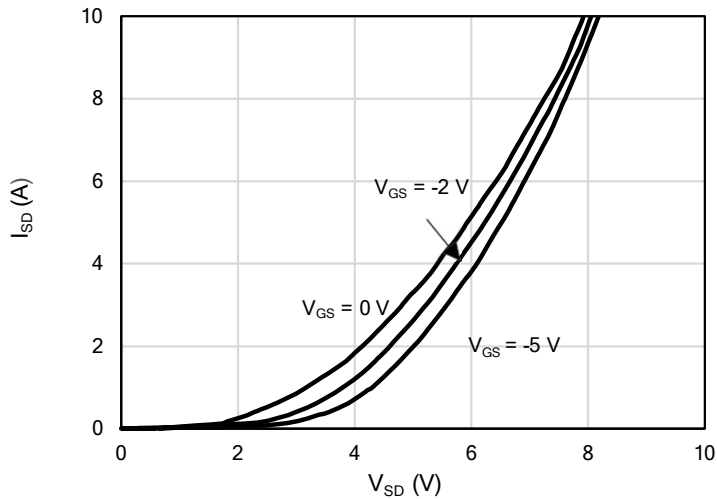


Figure 9: Body Diode Characteristics at 25°C

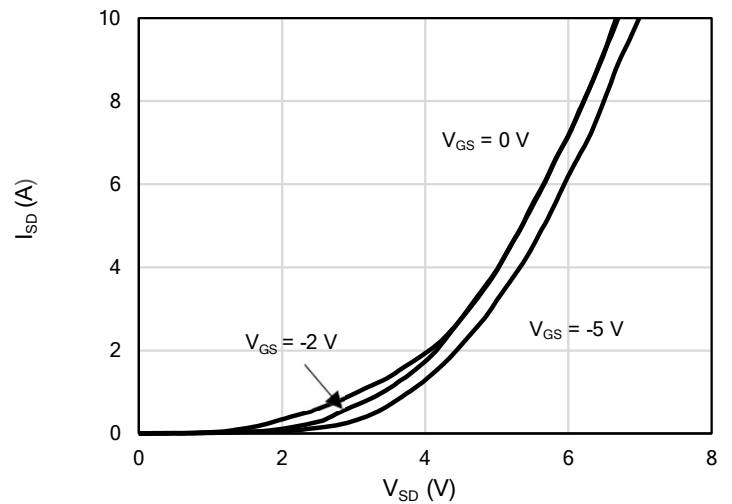


Figure 10: Body Diode Characteristics at 175°C

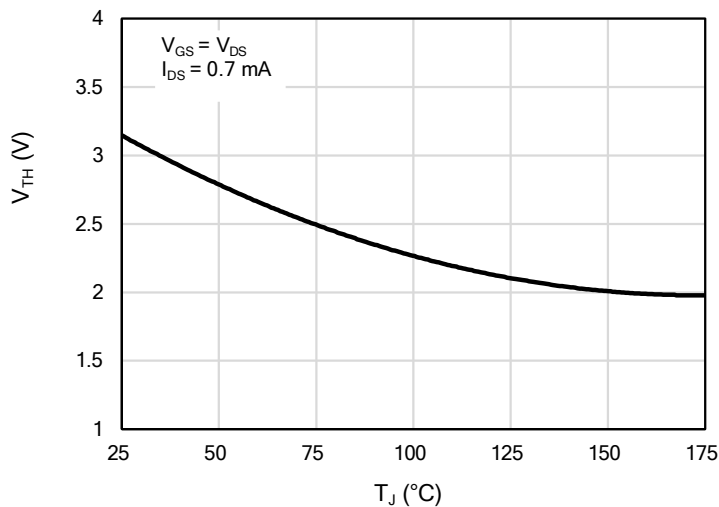


Figure 11: Threshold Voltage vs. Temperature

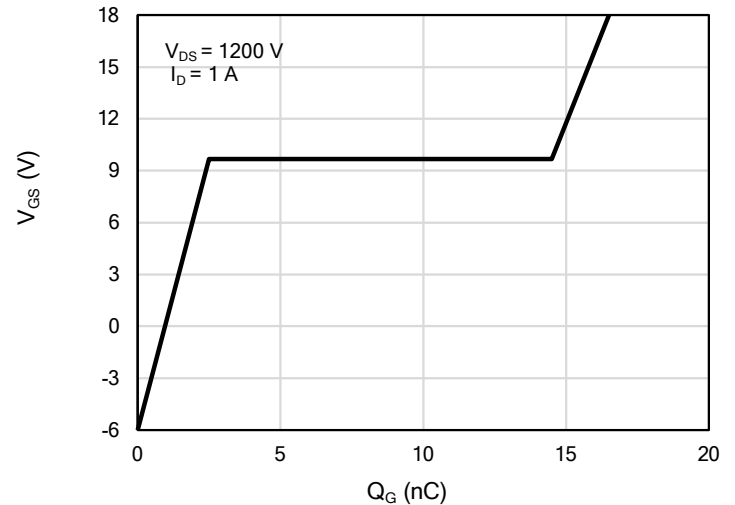


Figure 12: Gate-Charge Characteristics

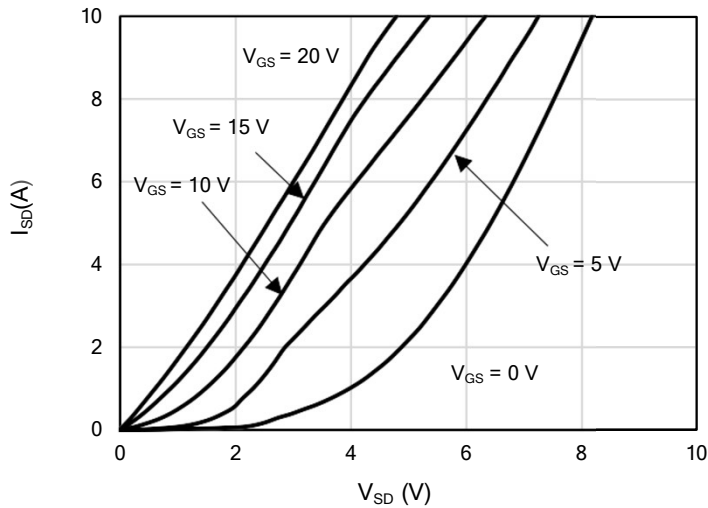


Figure 13: 3rd Quadrant Characteristics at -55°C

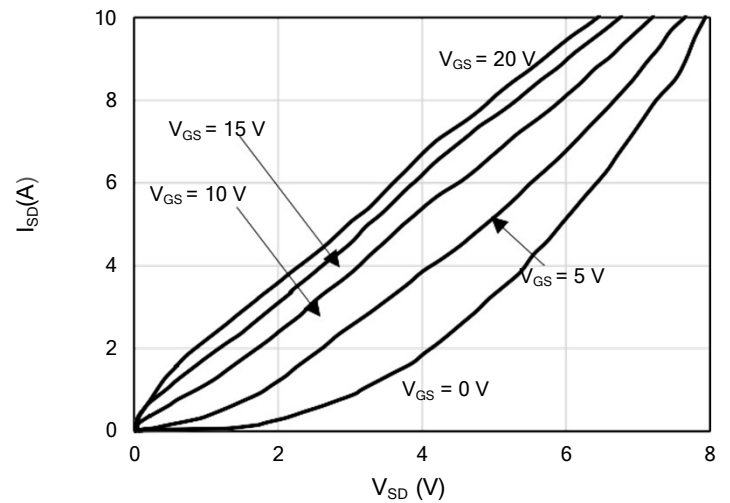


Figure 14: 3rd Quadrant Characteristics at 25°C

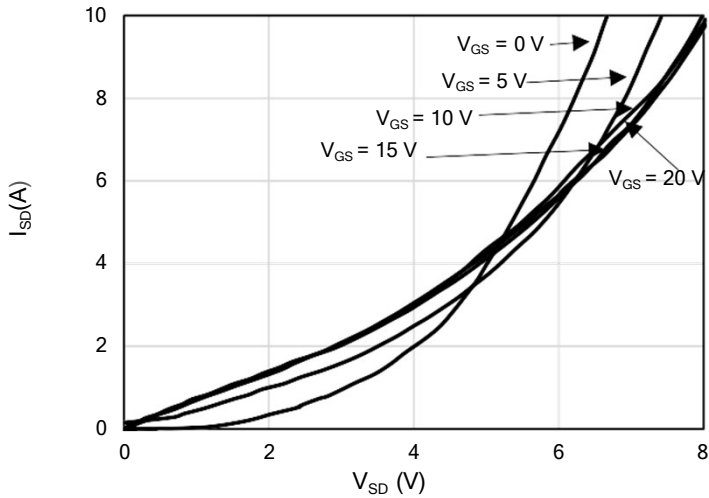


Figure 15: 3rd Quadrant Characteristics at 175°C

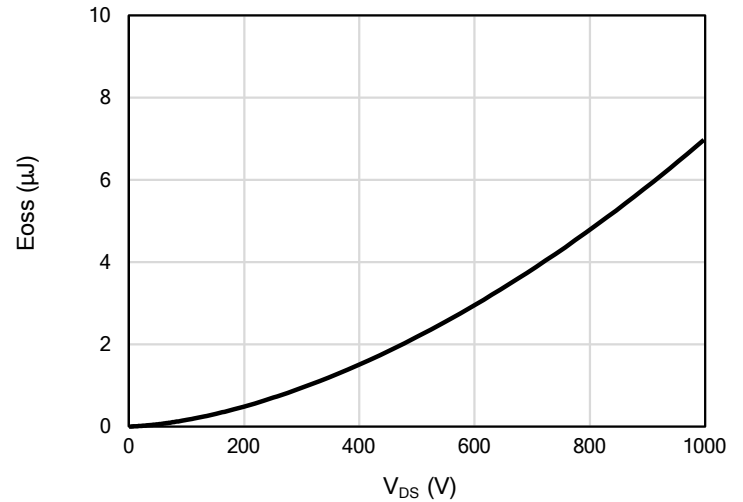


Figure 16: Output Capacitor Stord Energy

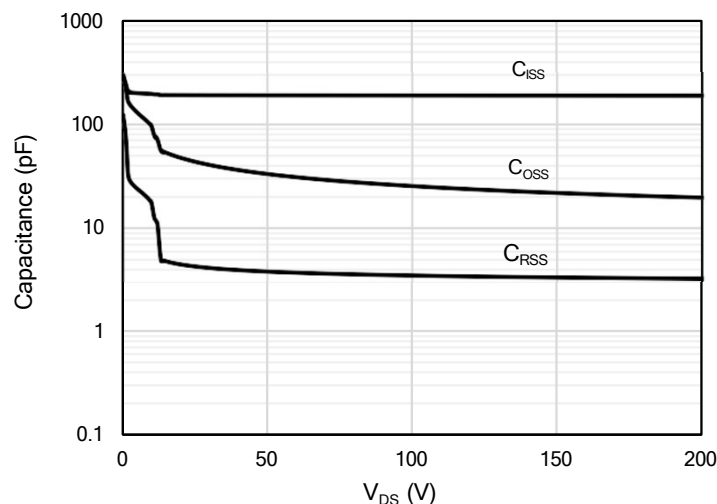


Figure 17: Capacitance Characteristics (0 - 200V)

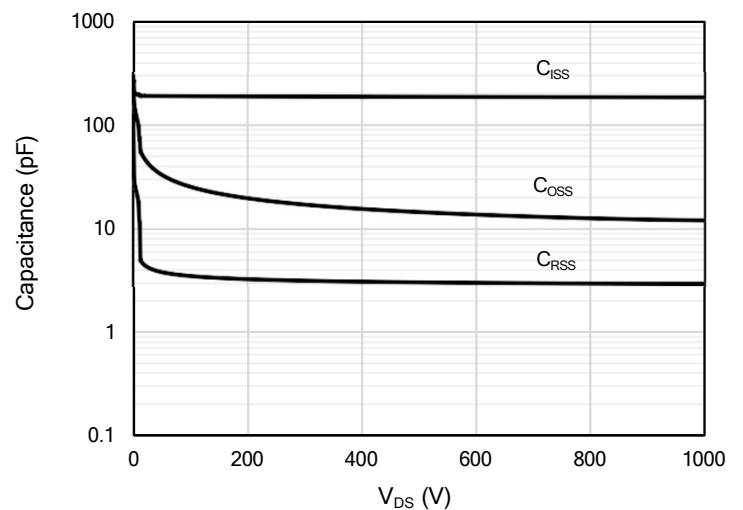


Figure 18: Capacitance Characteristics (0-1000V)

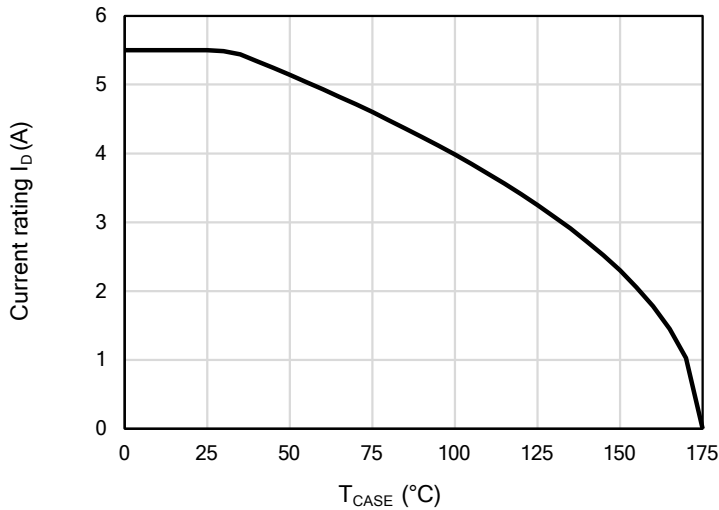


Figure 19: Current De-rating

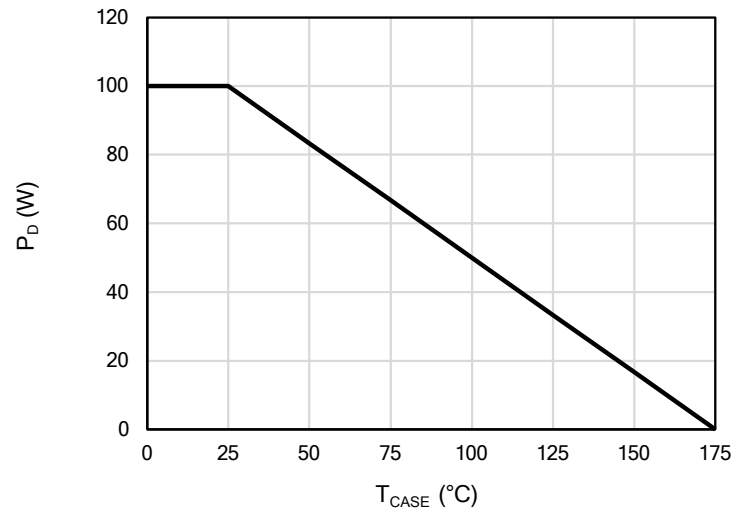


Figure 20: Maximum Power Dissipation Derating vs CaseTemperature

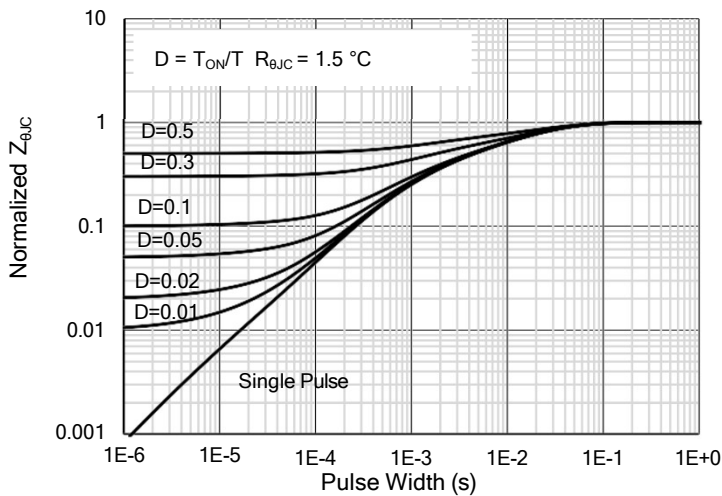


Figure 21: Normalized Maximum Transient Thermal Impedance

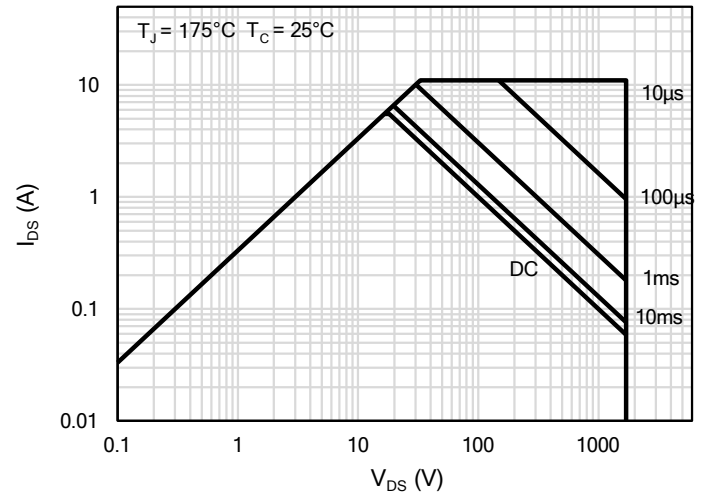


Figure 22: Maximum Forward Biased Safe Operating Area

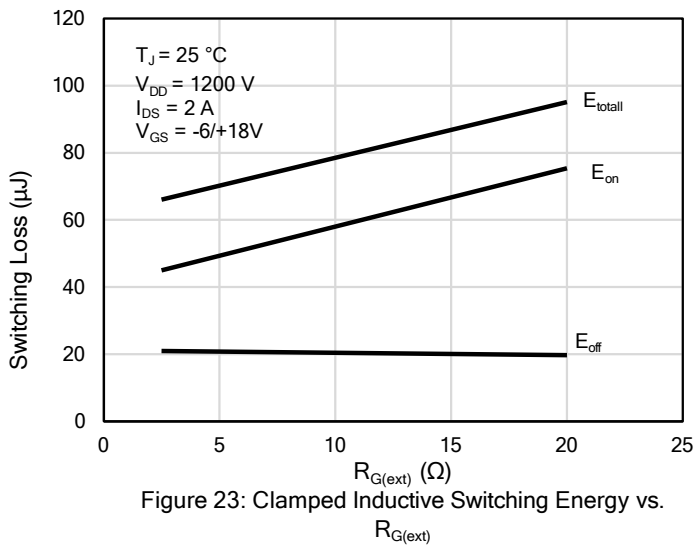


Figure 23: Clamped Inductive Switching Energy vs. $R_{G(ext)}$

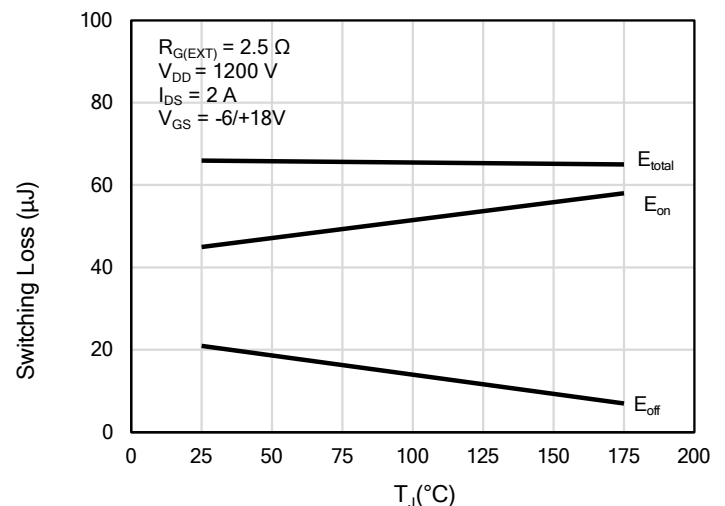


Figure 24: Clamped Inductive Switching Energy vs. T_J

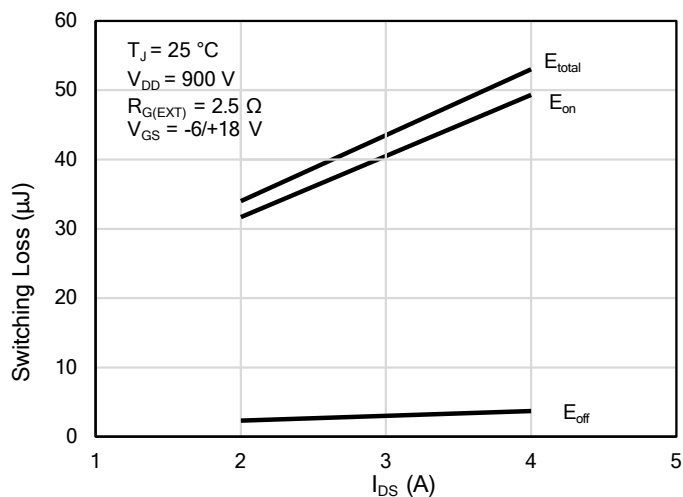


Figure 25: Clamped Inductive Switching Energy vs. Drain Current ($V_{DD} = 600 \text{ V}$)

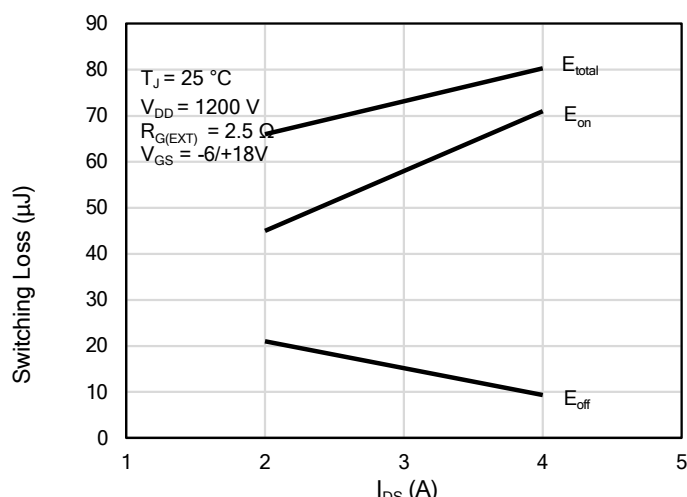


Figure 26: Clamped Inductive Switching Energy vs. Drain Current ($V_{DD} = 1200 \text{ V}$)

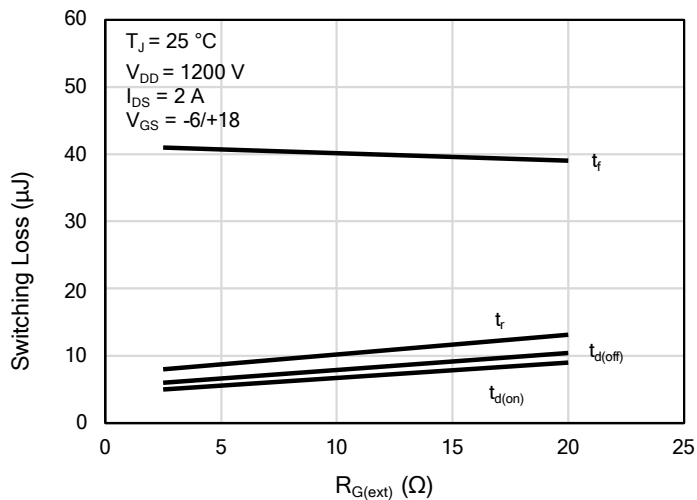
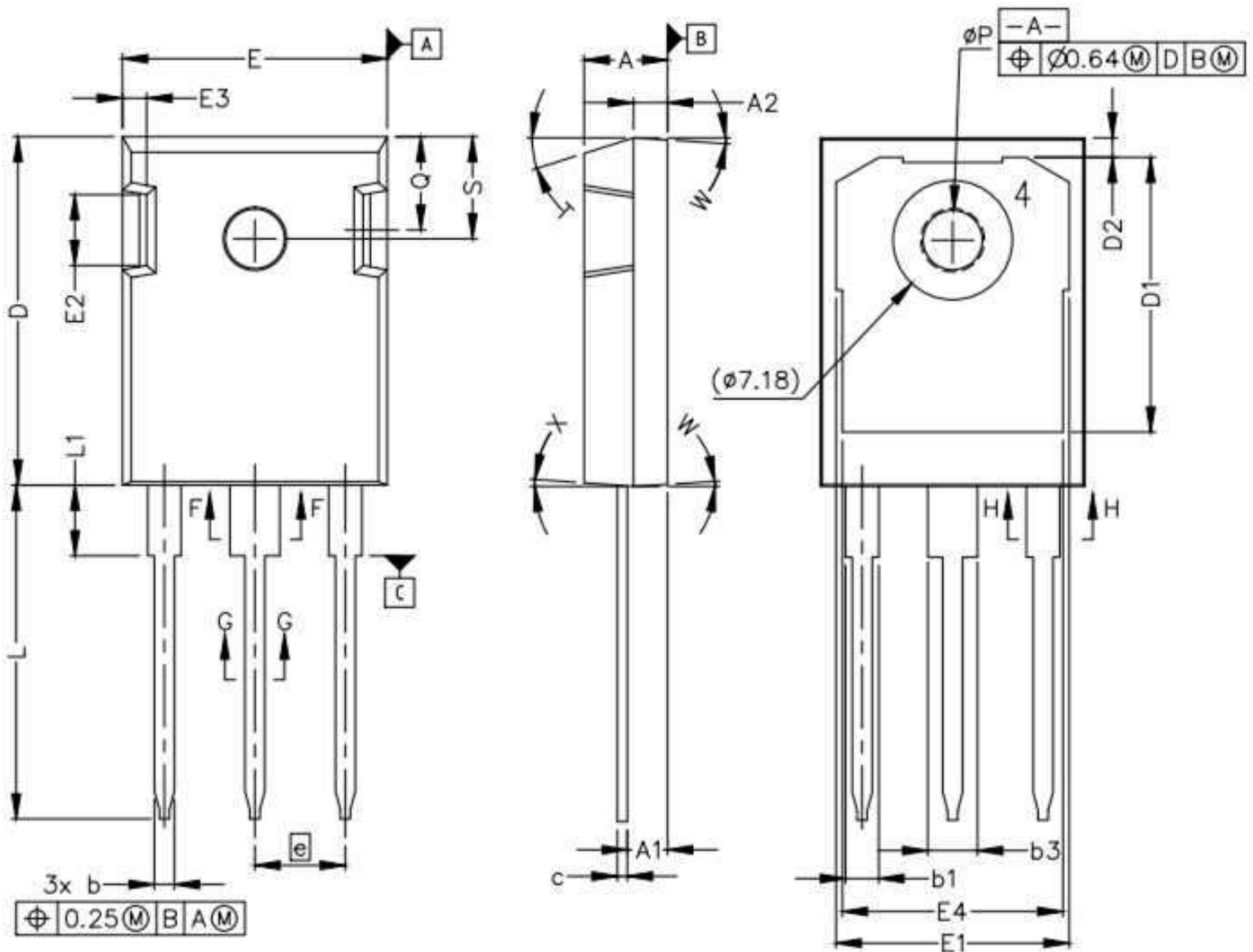


Figure 27: Switching Time vs. $R_{G(ext)}$

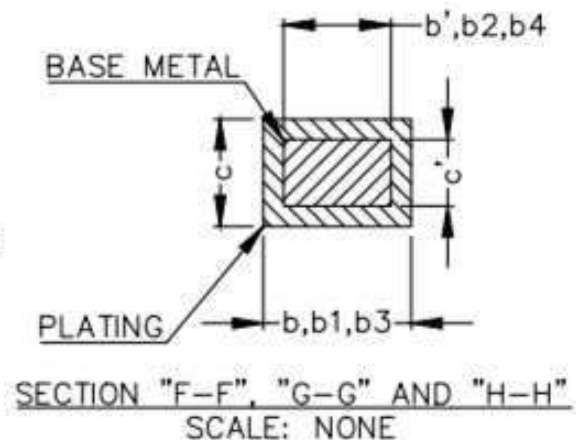
Package Outline: TO-247



NOTE:

1. ALL METAL SURFACES: TIN PLATED EXCEPT AREA OF CUT
2. DIMENSIONING & TOLERANCING CONFIRM TO ASME Y14.5M-1994.
3. ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.
4. THIS DRAWING WILL MEET ALL DIMENSIONS REQUIREMENT OF JEDEC OUTLINES TO-247 AD.

- 1 - GATE
- 2 - DRAIN (COLLECTOR)
- 3 - SOURCE (EMITTER)
- 4 - DRAIN (COLLECTOR)



Package Outline: TO-247

SYMBOL	MIN	MAX
A	4.83	5.21
A1	2.29	2.54
A2	1.91	2.16
b'	1.07	1.28
b	1.07	1.33
b1	1.91	2.41
b2	1.91	2.16
b3	2.87	3.38
b4	2.87	3.13
c'	0.55	0.65
c	0.55	0.68
D	20.80	21.10
D1	16.25	17.65
D2	0.95	1.25
E	15.75	16.13
E1	13.10	14.15
E2	3.68	5.10
E3	1.00	1.90
E4	12.38	13.43
e	5.44 BSC	
N	3	
L	19.81	20.32
L1	4.10	4.40
ØP	3.51	3.65
Q	5.49	6.00
S	6.04	6.30
T	17.5° REF.	
W	3.5° REF.	
X	4° REF.	

Marking Information

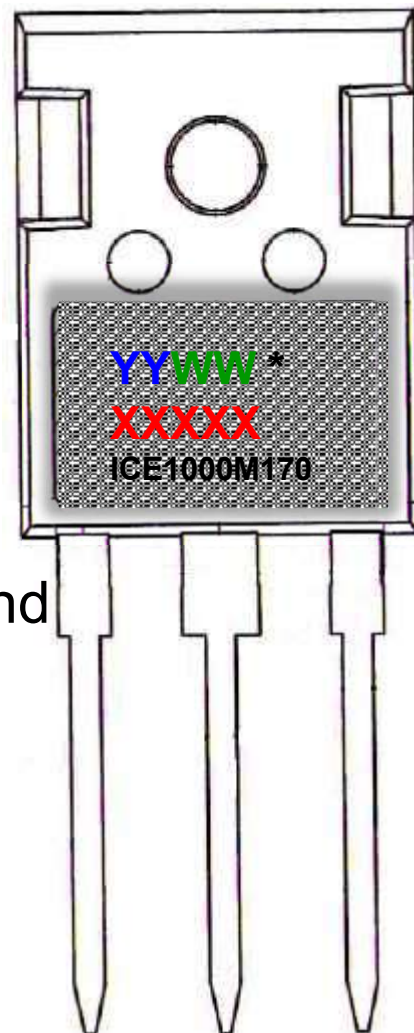
YY = Last two digits of the year

WW = Work week

***** = Site ID

XXXXXX = Lot ID

ICE1000M170 = ICE is IceMOS logo and 1000M170 is a designated device part number



Disclaimer

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