

### Product Summary

$V_{(BR)DSS}$	$R_{DS(on)TYP}$	$I_D@25^{\circ}C$
650V	95mΩ@18V	24A

### Feature

- Wide bandgap SiC MOSFET technology
- Low On-Resistance with High Blocking Voltage
- Low Capacitances with High-Speed switching
- Low reverse recovery(Qrr)

### Application

- Switch mode power supplies
- Renewable energy
- On board charger
- High voltage DC/DC converters

### Package

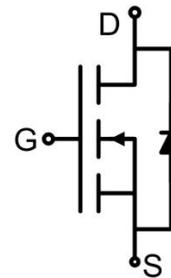


ITO-220AB

### Marking



### Circuit diagram



### Absolute maximum ratings ( $T_C=25^{\circ}C$ unless otherwise noted)

Parameter	Symbol	Test Condition	Value	Unit
Drain-Source Voltage	$V_{DSmax}$	$V_{GS} = 0V, I_D = 100\mu A$	650	V
Gate-Source Voltage	$V_{GS}$	$t_p \leq 500ns, \text{ duty cycle } \leq 1\%$	-8/+20	V
Gate-Source Voltage	$V_{GSOP}$	Static	-4/+18	V
Continuous Drain Current	$I_D$	$V_{GS} = 18V$	24	A
	$I_D$	$V_{GS} = 18V, T_C = 100^{\circ}C$	17	A
Pulsed Drain Current	$I_{D,pulse}$	Pulse with $t_p$ limited by $T_{jmax}$	53	A
Single pulse avalanche energy	$E_{AS}$	$V_{DS} = 650V, V_{DD} = 50V, V_{GS} = 10V, L = 10mH$	332	mJ
Power Dissipation	$P_D$	$T_J = 175^{\circ}C$	64	W
Thermal Resistance (Typ)	$R_{\theta JC}$	Junction-to-Case	2.35	$^{\circ}C/W$
Operating Junction Temperature	$T_J$		-55~ +175	$^{\circ}C$
Storage Temperature	$T_{STG}$		-55~ +175	$^{\circ}C$

### Electrical characteristics (T<sub>J</sub>=25°C, unless otherwise noted)

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit	
<b>Static Characteristics</b>							
Drain-source breakdown voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0V, I <sub>D</sub> = 100μA	650			V	
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>DS</sub> = 650V, V <sub>GS</sub> = 0V			50	μA	
Gate-Source leakage current	I <sub>GSS</sub>	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 18V			250	nA	
Gate threshold voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 4mA		3		V	
		V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 4mA, T <sub>J</sub> = 175°C		2			
Drain-source on-resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 18V, I <sub>D</sub> = 10A		95	125	mΩ	
		V <sub>GS</sub> = 18V, I <sub>D</sub> = 10A, T <sub>J</sub> = 175°C		135			
Transconductance	g <sub>fs</sub>	V <sub>GS</sub> = 18V, I <sub>D</sub> = 10A		7		S	
		V <sub>GS</sub> = 18V, I <sub>D</sub> = 10A, T <sub>J</sub> = 175°C		6			
<b>Dynamic characteristics</b>							
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 600V, V <sub>GS</sub> = 0V V <sub>AC</sub> = 25mV, f = 1MHz		803		pF	
Output Capacitance	C <sub>oss</sub>			77			
Reverse Transfer Capacitance	C <sub>rss</sub>			5			
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> = 400V, V <sub>GS</sub> = -4V/18V I <sub>D</sub> = 10A		34		nC	
Gate-Source Charge	Q <sub>gs</sub>			7.8			
Gate-Drain Charge	Q <sub>gd</sub>			9			
Internal Gate Resistance	R <sub>G(int)</sub>	V <sub>AC</sub> = 25mV, f = 1MHz		3.8		Ω	
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DS</sub> = 400V, V <sub>GS</sub> = -4V/+18V I <sub>D</sub> = 10A, R <sub>G(ext)</sub> = 5Ω, L = 294μH		5		nS	
Turn-on rise time	t <sub>r</sub>			18			
Turn-off delay time	t <sub>d(off)</sub>			17			
Turn-off fall time	t <sub>f</sub>			10			
Turn-on Switching Energy	E <sub>on</sub>				43		μJ
Turn-off Switching Energy	E <sub>off</sub>				17		
Total switching energy	E <sub>tot</sub>				60		
<b>Source-Drain Diode characteristics</b>							
Diode Forward Current	I <sub>S</sub>	V <sub>GS</sub> = -5V, T <sub>C</sub> = 25°C		19		A	
Diode Forward voltage	V <sub>SD</sub>	V <sub>GS</sub> = -5V, I <sub>SD</sub> = 5A		1.4	4	V	
		V <sub>GS</sub> = -5V, I <sub>SD</sub> = 5A, T <sub>J</sub> = 175°C		1.9	4.5		
Reverse Recovery Time	T <sub>rr</sub>	V <sub>GS</sub> = -4V, I <sub>SD</sub> = 10A, V <sub>R</sub> = 400V dif/dt = 1000 A/μs		29		nS	
Reverse Recovery Charge	Q <sub>rr</sub>			63		nC	
Peak Reverse Recovery Current	I <sub>rrm</sub>			5		A	

## Typical Characteristics

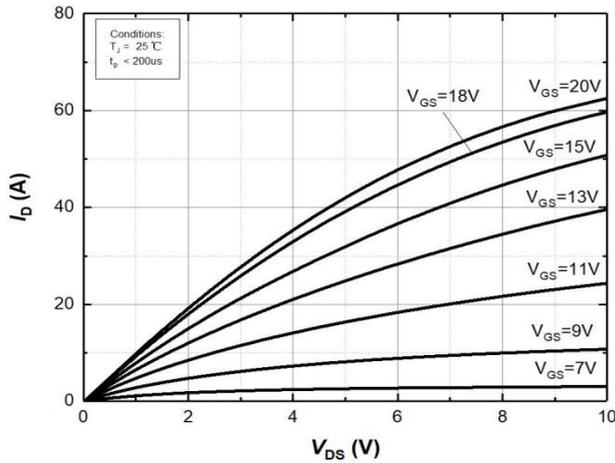


Figure 1. Output characteristics at  $T_j=25^\circ\text{C}$

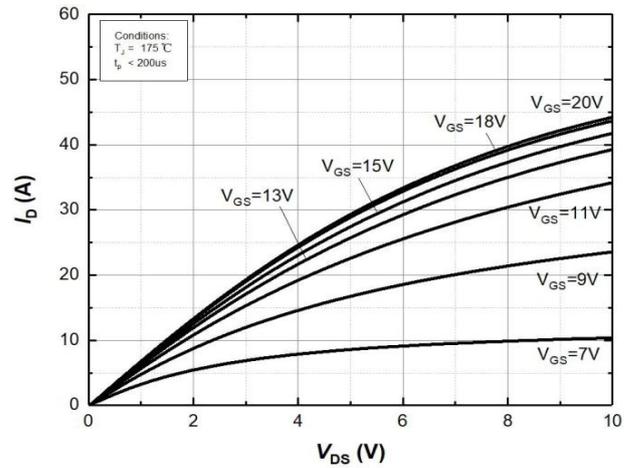


Figure 2. Output characteristics at  $T_j=175^\circ\text{C}$

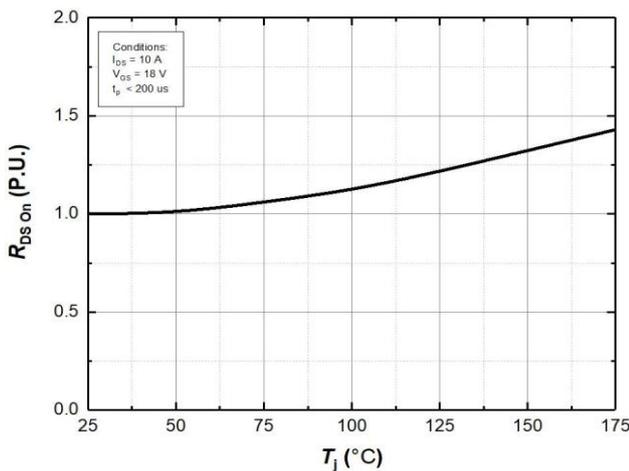


Figure 3. Normalized On-Resistance vs. Temperature

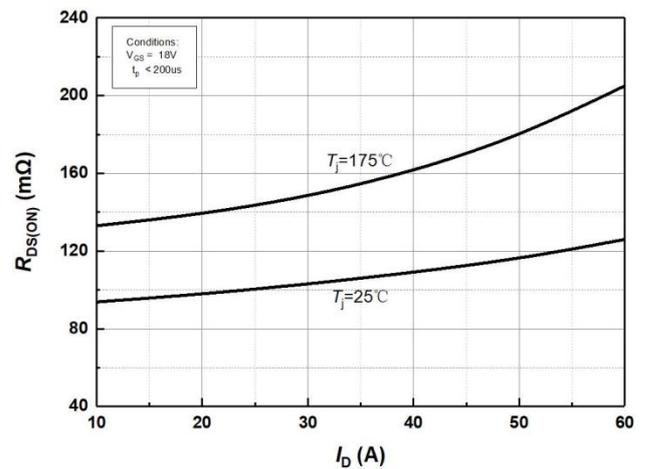


Figure 4. On-Resistance vs. Drain current for Various Temperature

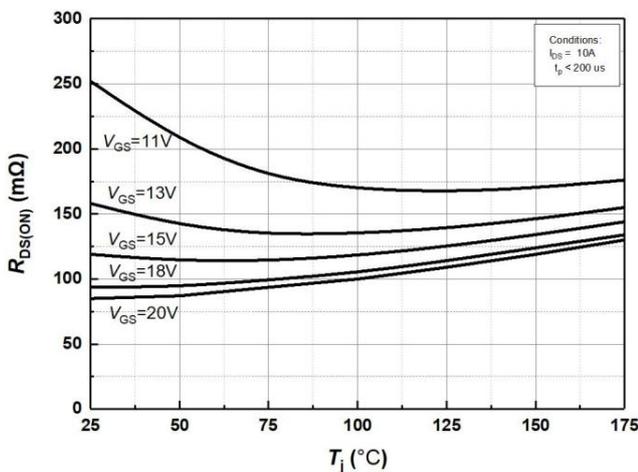


Figure 5. On-Resistance vs. Temperature for Various Gate Voltage

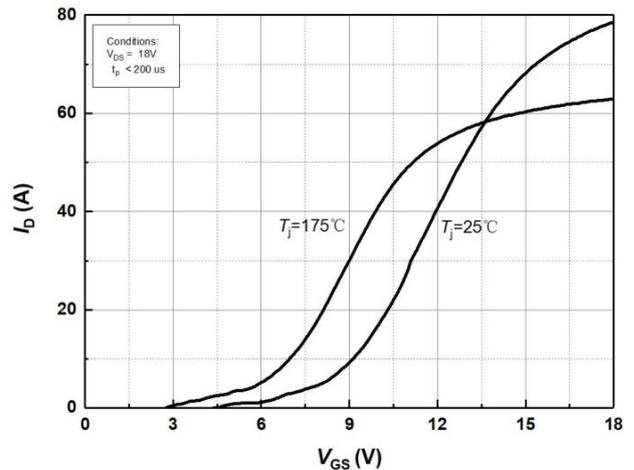


Figure 6. Transfer Characteristics for Various Junction Temperatures

## Typical Characteristics

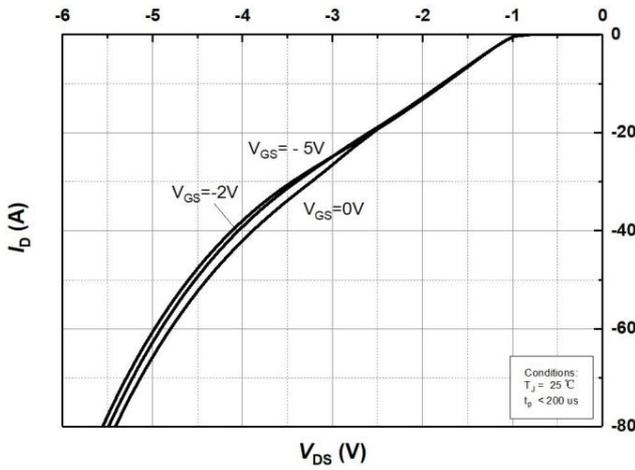


Figure 7. Body Diode Characteristics at Tj=25°C

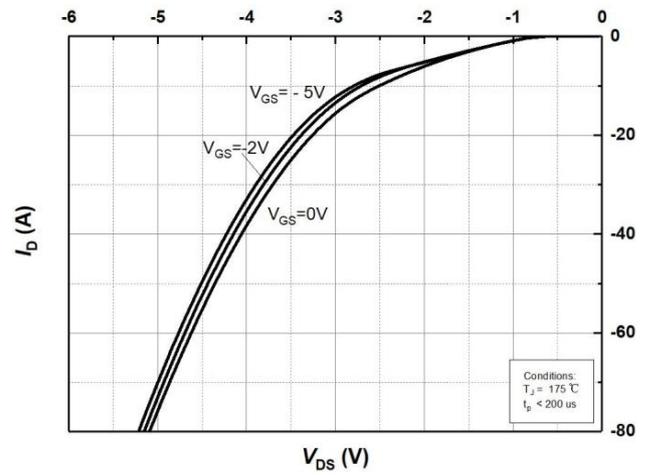


Figure 8. Body Diode Characteristics at Tj=175°C

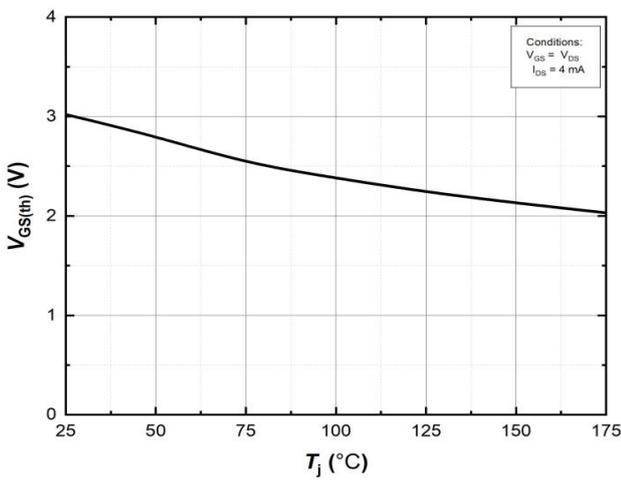


Figure 9. Threshold Voltage vs. Temperature

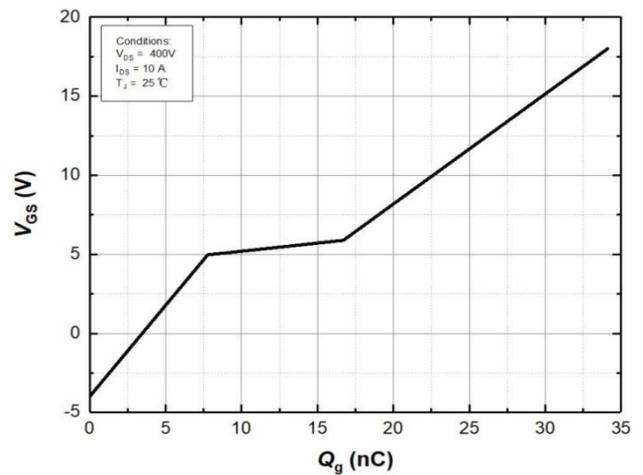


Figure 10 Gate Charge Characteristics

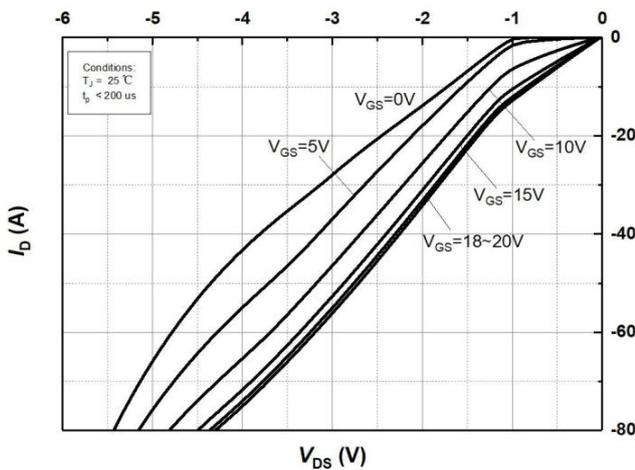


Figure 11. 3rd Quadrant Characteristic at Tj=25°C

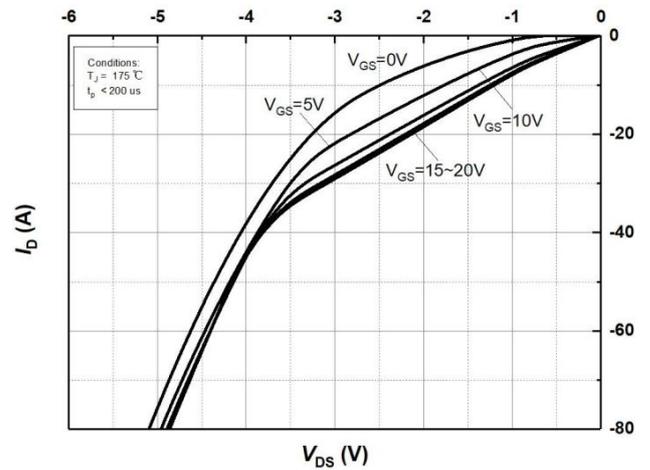


Figure 12. 3rd Quadrant Characteristic at Tj=175°C

## Typical Characteristics

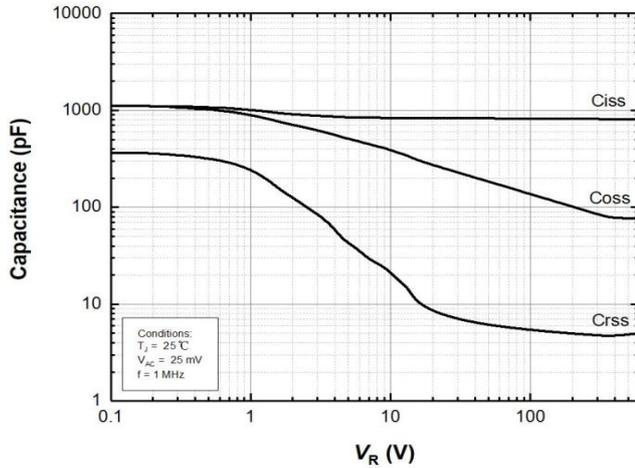


Figure 13. Capacitances vs. Drain-Source Voltage (0 – 600V)

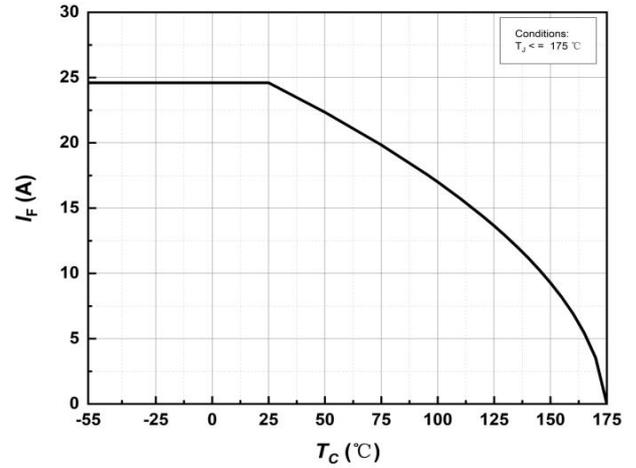


Figure 14. Continuous Drain Current Derating vs Case Temperature

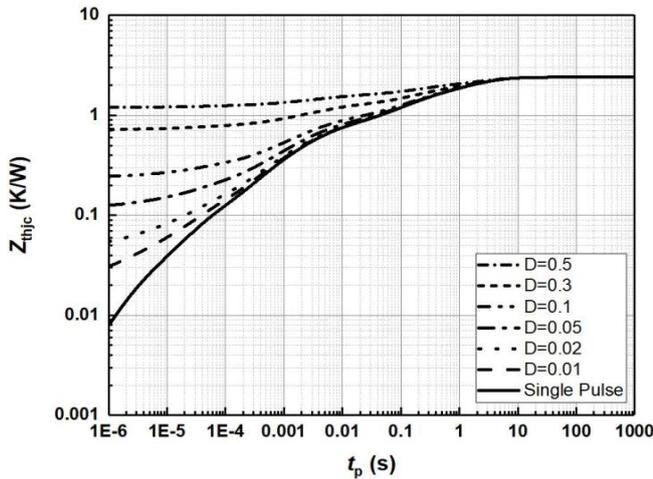


Figure 15. Transient Thermal Impedance (Junction – Case)

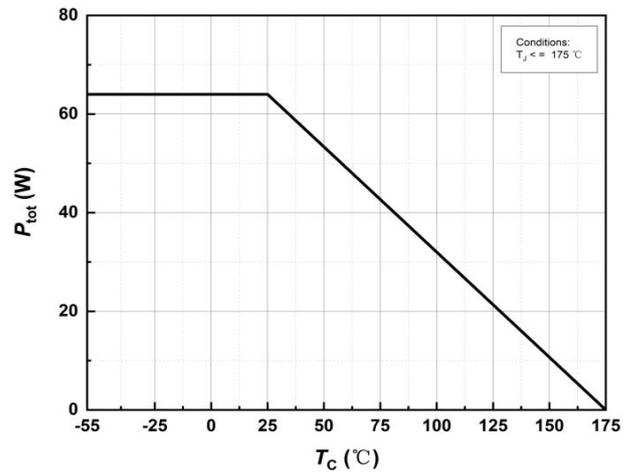


Figure 16. Maximum Power Dissipation Derating vs. Case Temperature

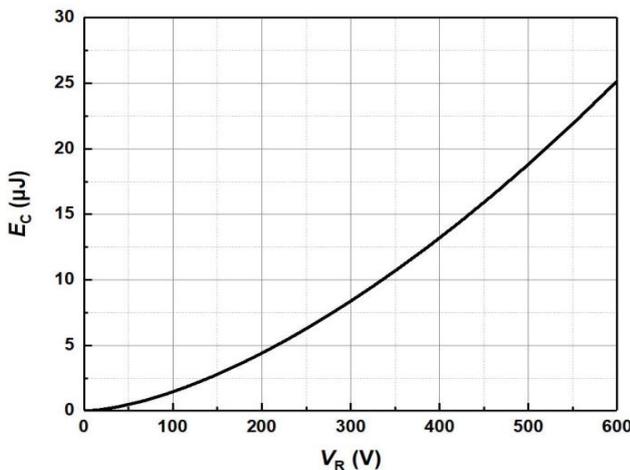


Figure 17. Output Capacitor Stored Energy

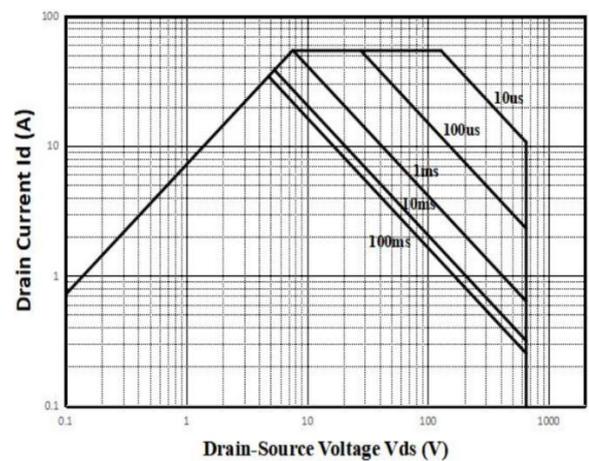


Figure 18. Safe Operating Area

## Typical Characteristics

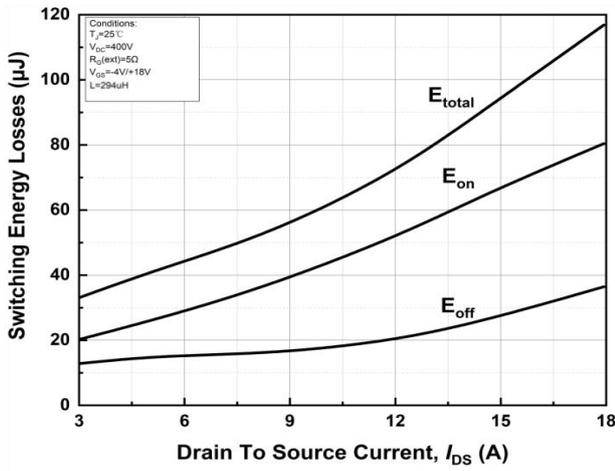


Figure 19. Clamped Inductive Switching Energy vs. Drain Current ( $V_{DD} = 400V$ )

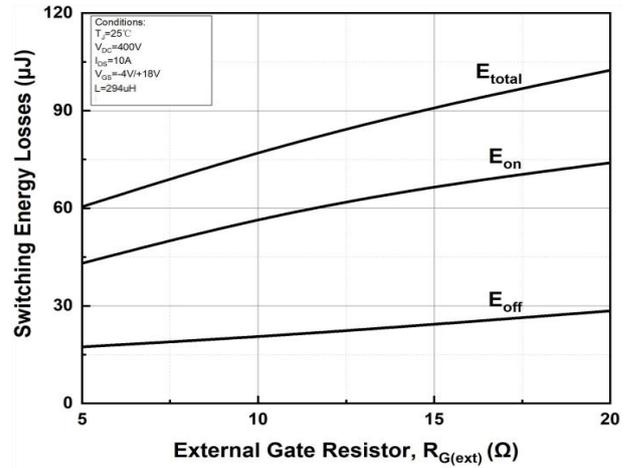


Figure 20. Clamped Inductive Switching Energy vs.  $R_{G(ext)}$

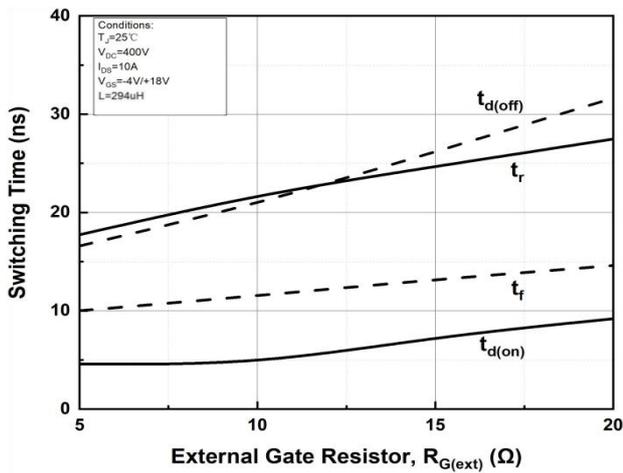
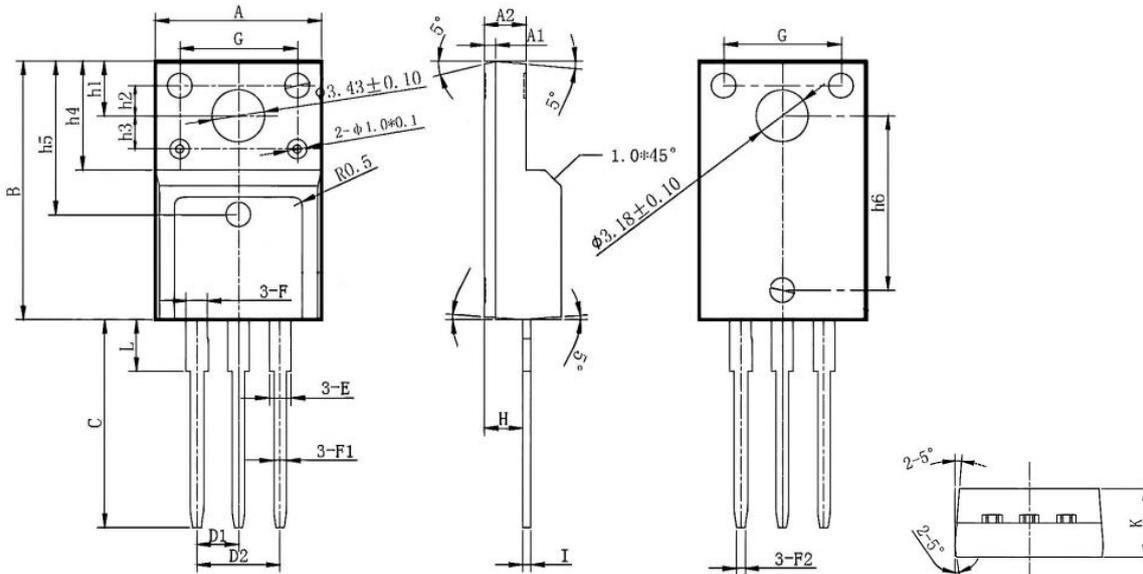


Figure 21. Switching Times vs.  $R_{G(ext)}$

### ITO-220AB Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	10.000	10.400	0.394	0.409
A1	0.700 REF.		0.028 REF.	
A2	2.350	2.750	0.093	0.108
B	15.800	16.000	0.622	0.630
C	13.000	13.500	0.512	0.531
D1	2.540 BSC.		0.100 BSC.	
D2	5.080 BSC.		0.200 BSC.	
E	1.270	1.400	0.050	0.055
F	1.250	1.300	0.049	0.051
F1	0.750	0.850	0.030	0.033
F2	0.350	0.500	0.014	0.020
G	6.900	7.100	0.272	0.280
H	2.660	2.860	0.105	0.113
h1	3.200	3.400	0.126	0.134
h2	1.700	1.900	0.067	0.075
h3	2.000	2.200	0.079	0.087
h4	6.700	6.900	0.264	0.272
h5	9.300	9.500	0.366	0.374
h6	10.440	10.640	0.411	0.419
I	0.400	0.600	0.016	0.024
K	4.600	4.800	0.181	0.189
L	2.900	3.100	0.114	0.122