

### Product Summary

$V_{(BR)DSS}$	$R_{DS(on)MAX}$	$I_D$
650V	180mΩ@10V	21A

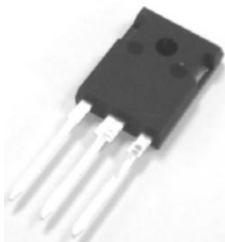
### Feature

- Low on-resistance and low conduction losses
- Ultra Low Gate Charge cause lower driving requirements
- New technology for high voltage device
- Suffix "-Q1" for AEC-Q101

### Application

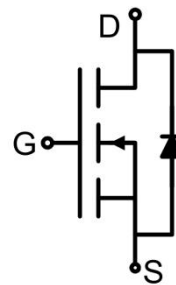
- Power factor correction
- Switched mode power supplies
- Uninterruptible Power Supply

### Package



TO-247AB

### Circuit diagram



### Marking



### Absolute maximum ratings (Ta=25°C unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V <sub>DS</sub>	650	V
Gate-Source Voltage	V <sub>GS</sub>	±30	V
Continuous Drain Current	I <sub>D</sub>	21	A
Drain Current-Continuous(T <sub>C</sub> =100 °C )	I <sub>D</sub> (100 °C)	13.2	A
Pulsed Drain Current	I <sub>DM</sub>	84	A
Power Dissipation	P <sub>D</sub>	188	W
Thermal Resistance,Junction-to-Case	R <sub>θJC</sub>	0.66	°C/W
Single pulse avalanche energy	E <sub>AS</sub>	441	mJ
Junction Temperature	T <sub>J</sub>	150	°C
Storage Temperature	T <sub>STG</sub>	-55 ~ +150	°C

### Electrical characteristics (T<sub>A</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> =250μA	650			V
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>DS</sub> =650V, V <sub>GS</sub> = 0V			1	μA
Gate-body leakage current	I <sub>GSS</sub>	V <sub>GS</sub> =±20V, V <sub>DS</sub> = 0V			±100	nA
Gate threshold voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	3		4	V
Drain-source on-resistance <sup>1)</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =10.5A		150	180	mΩ
<b>Dynamic characteristics<sup>2)</sup></b>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =50V, V <sub>GS</sub> =0V, f =1MHz		2250		pF
Output Capacitance	C <sub>oss</sub>			83		
Reverse Transfer Capacitance	C <sub>rss</sub>			1.6		
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =480V, V <sub>GS</sub> =10V, I <sub>D</sub> =21A		36		nC
Gate-Source Charge	Q <sub>gs</sub>			14		
Gate-Drain Charge	Q <sub>gd</sub>			8.5		
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> =380V, V <sub>GS</sub> =10V, I <sub>D</sub> =11A, R <sub>GEN</sub> =4Ω		11		nS
Turn-on rise time	t <sub>r</sub>			6		
Turn-off delay time	t <sub>d(off)</sub>			61		
Turn-off fall time	t <sub>f</sub>			4.5		
<b>Source-Drain Diode characteristics</b>						
Diode Forward Current <sup>1)</sup>	I <sub>S</sub>				21	A
Diode Forward voltage	V <sub>DS</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =21A			1.3	V
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> = 25°C, I <sub>F</sub> =21A		310		nS
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 100A/μs <sup>1)</sup>		5		μC

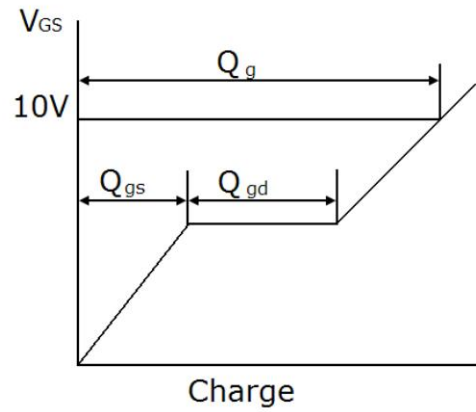
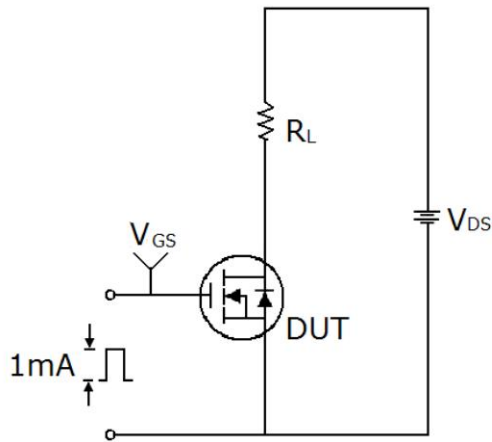
Notes:

1) Pulse Test: Pulse Width < 300μs, Duty Cycle ≤2%.

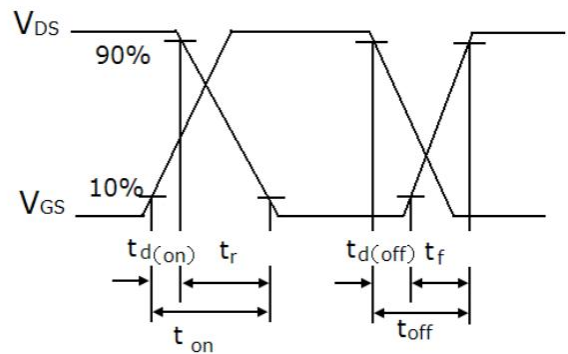
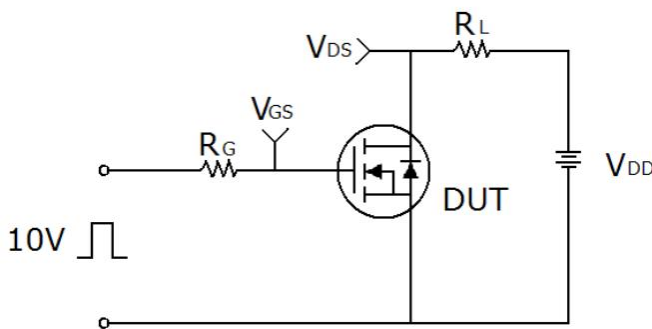
2) Guaranteed by design, not subject to production testing.

## Test Circuit

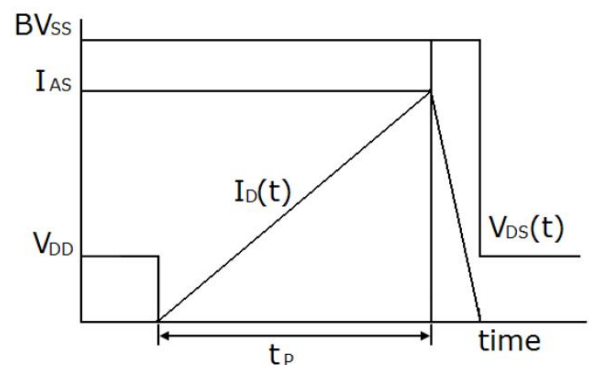
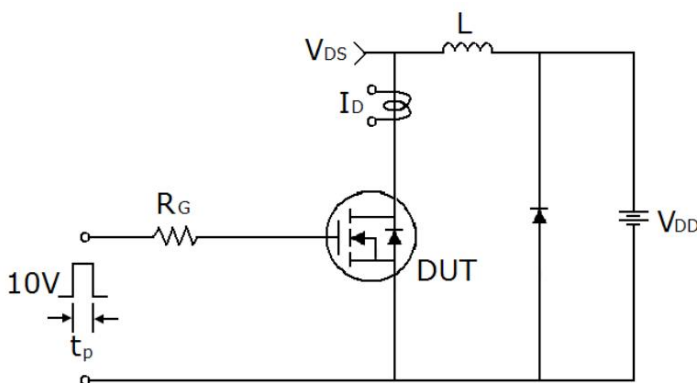
### 1) Gate charge test circuit & Waveform



### 2) Switch Time Test Circuit

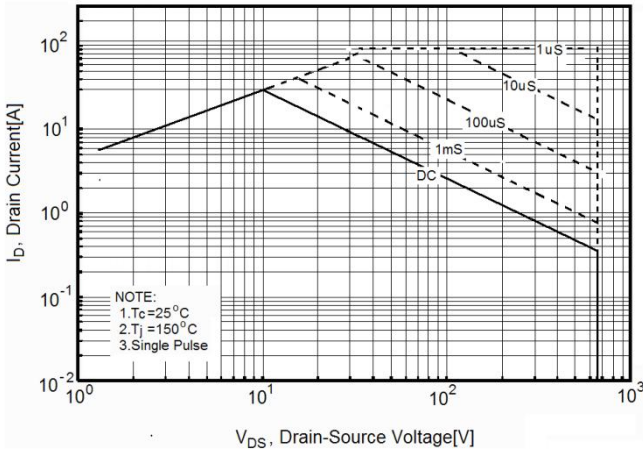


### 3) Unclamped Inductive Switching Test Circuit & Waveforms

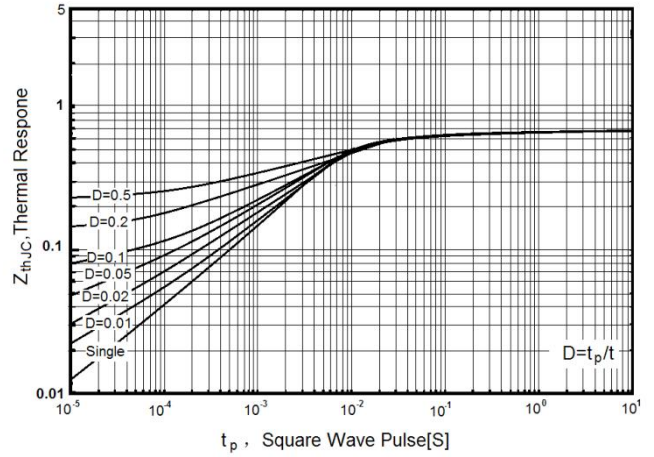


### Typical Characteristics

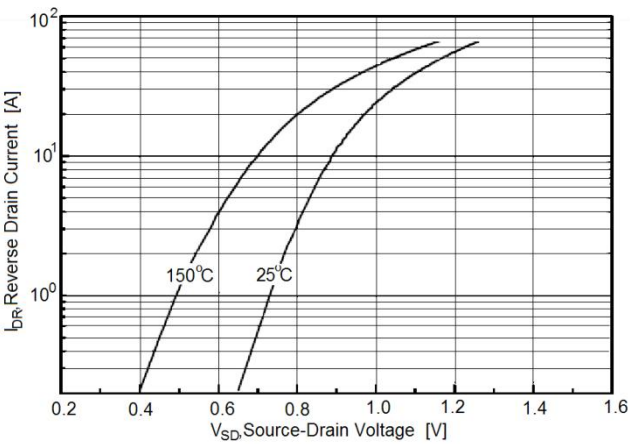
**Figure1. Safe operating area**



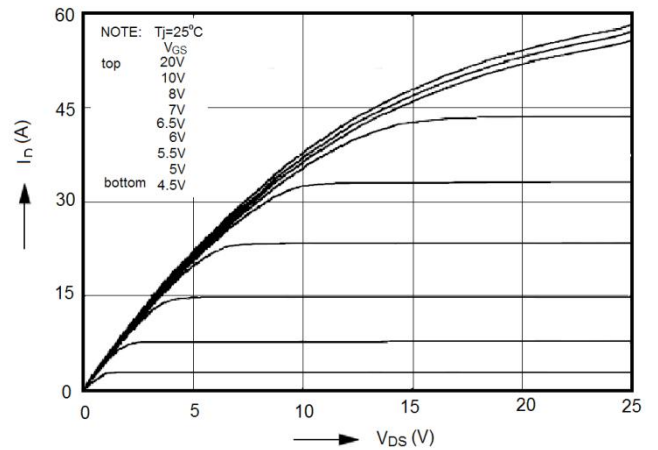
**Figure2. Transient Thermal Impedance**



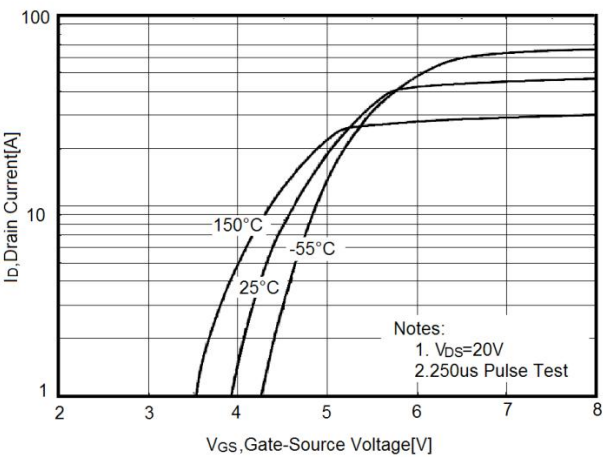
**Figure3. Source-Drain Diode Forward Voltage**



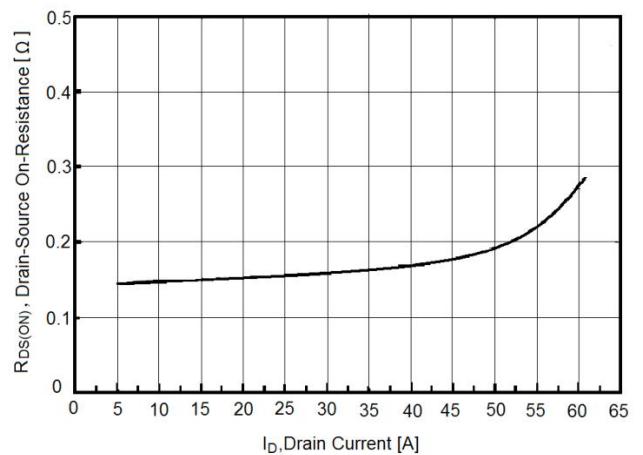
**Figure4. Output characteristics**



**Figure5. Transfer characteristics**



**Figure6. Static drain-source on resistance**



## Typical Characteristics

Figure7.  $R_{DS(ON)}$  vs Junction Temperature

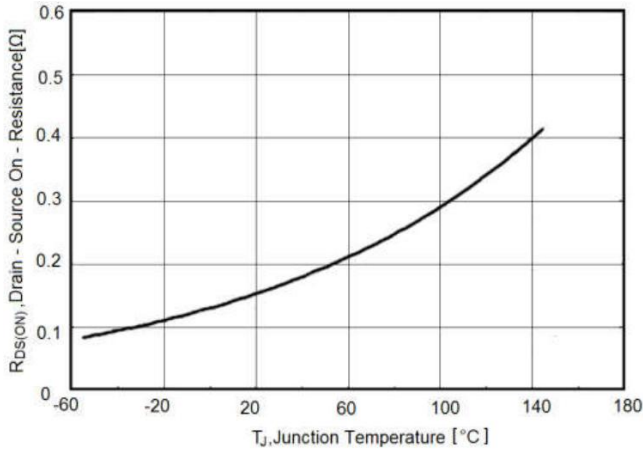


Figure8.  $BV_{DSS}$  vs Junction Temperature

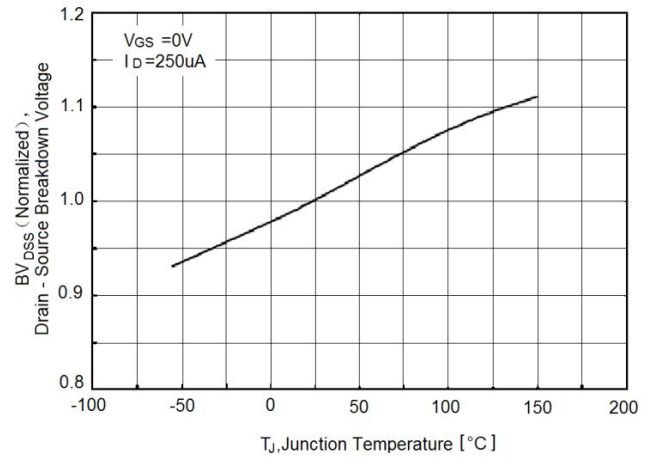


Figure9. Maximum  $I_D$  vs Junction Temperature

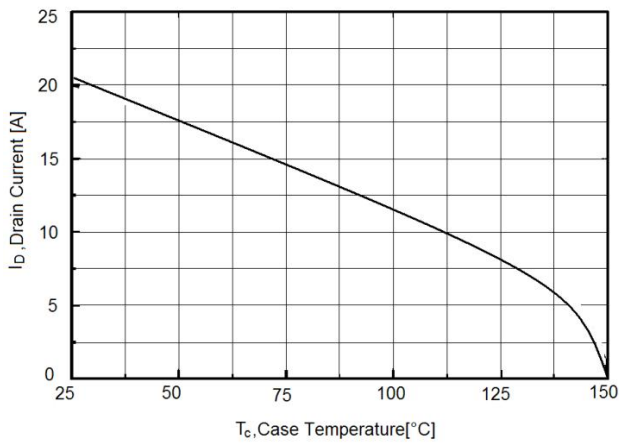


Figure10. Gate charge waveforms

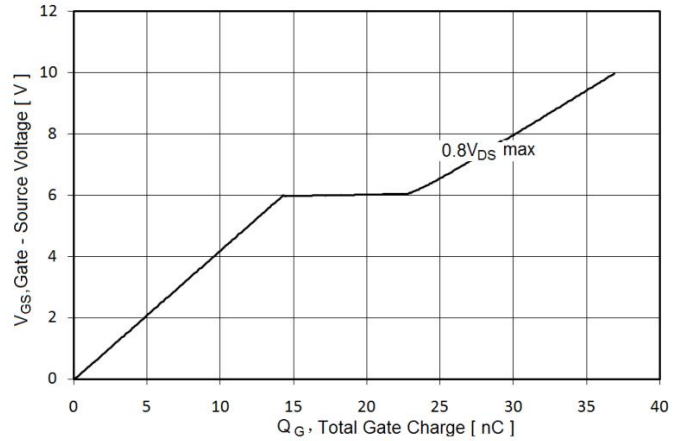
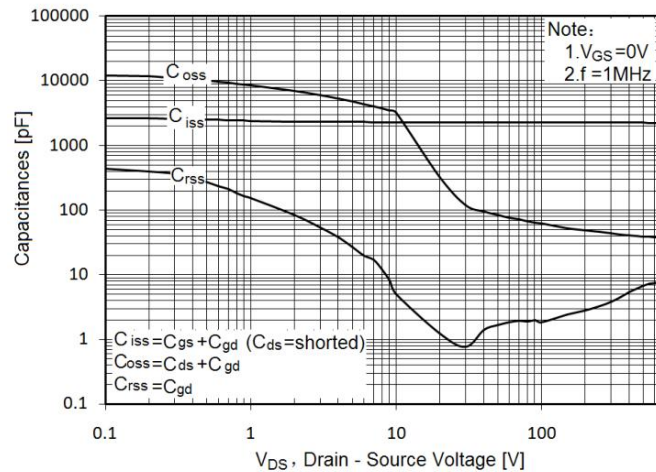
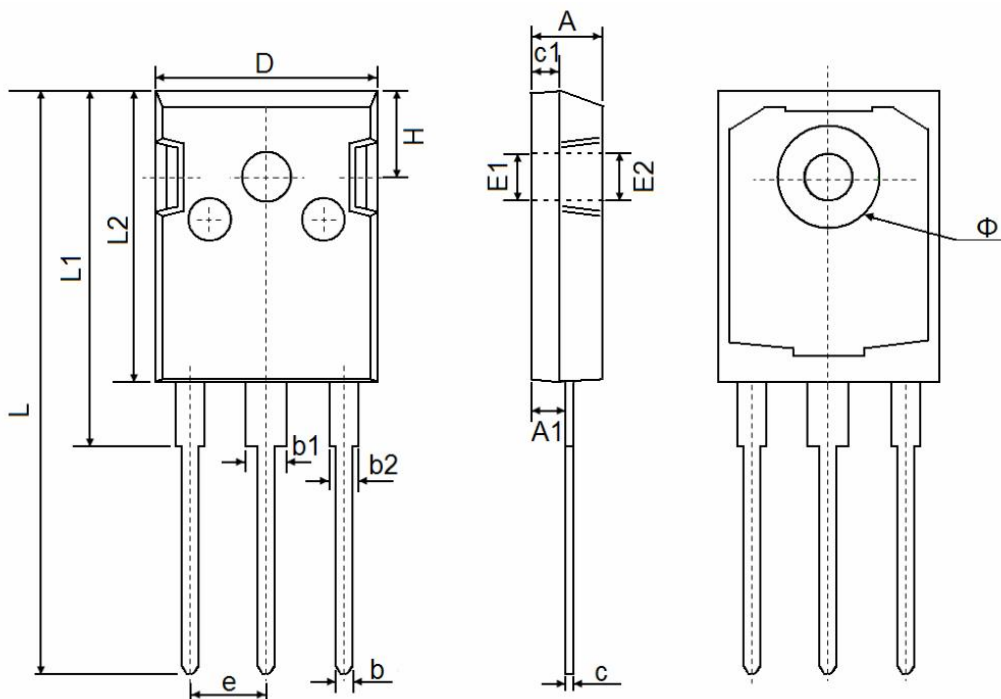


Figure11. Capacitance



### TO-247AB Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.850	5.150	0.191	0.200
A1	2.200	2.600	0.087	0.102
b	1.000	1.400	0.039	0.055
b1	2.800	3.200	0.110	0.126
b2	1.800	2.200	0.071	0.087
c	0.500	0.700	0.020	0.028
c1	1.900	2.100	0.075	0.083
D	15.450	15.750	0.608	0.620
E1	3.500 REF		0.138 REF	
E2	3.600 REF		0.142 REF	
L	40.900	41.300	1.610	1.626
L1	24.800	25.100	0.976	0.988
L2	20.300	20.600	0.799	0.811
Φ	7.100	7.300	0.280	0.287
e	5.450 TYP		0.215 TYP	
H	5.980 REF		0.235 REF	