

### Description

The LM3415A uses advanced trench technology. It utilizes the latest processing techniques to achieve the high cell density and reduces the on-resistance with high repetitive avalanche rating. These features combine to make this design an extremely efficient and reliable device for use in power switching application and a wide variety of other applications.

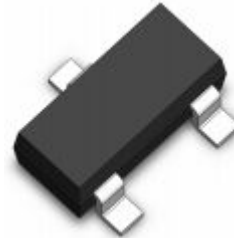
### General Features

$V_{DS} = -20V, I_D = -4.2A$   
 $R_{DS(ON)} < 37m\Omega @ V_{GS}=4.5V$   
 ESD=3000V HBM

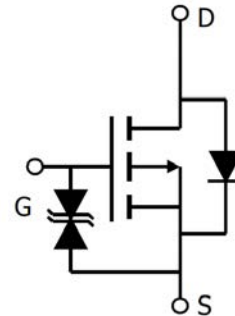
### Application

- Advanced MOSFET process technology
- Special designed for PWM, load switching and general purpose applications
- Ultra low on-resistance with low gate charge
- Fast switching and reverse body recovery
- 150°C operating temperature

### Dimensions SOT-23



### Pin Configuration



### Package Marking and Ordering Information

Device	Device Marking	Device Package	Reel Size	Tape width	Quantity
LM3415A	AP3415A	SOT-23	Ø180mm	8 mm	3000 units

### Absolute Maximum Ratings (TC=25°C unless otherwise noted)

Symbol	Parameter	Max.	Units
$I_D @ TC = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	-4.2 <sup>①</sup>	A
$I_D @ TC = 70^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	-2.4 <sup>①</sup>	
$I_{DM}$	Pulsed Drain Current <sup>②</sup>	-30	
$P_D @ TC = 25^\circ C$	Power Dissipation <sup>③</sup>	1.4	W
$V_{DS}$	Drain-Source Voltage	-20	V
$V_{GS}$	Gate-to-Source Voltage	± 8	V
$T_J, T_{STG}$	Operating Junction and Storage Temperature Range	-55 to +150	°C
$R_{\theta JA}$	Junction-to-ambient (t ≤ 10s) <sup>④</sup>	90	°C/W

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
V(BR)DSS	Drain-to-Source breakdown voltage	V <sub>GS</sub> = 0V, I <sub>D</sub> = -250μA	-20	—	—	V
R <sub>DS(on)</sub>	Static Drain-to-Source on-resistance	V <sub>GS</sub> =-4.5V, I <sub>D</sub> = -4A	—	37	43	mΩ
		V <sub>GS</sub> =-2.5V, I <sub>D</sub> = -4A	—	45	54	
		V <sub>GS</sub> =-1.8V, I <sub>D</sub> = -2A	—	56	73	
V <sub>GS(th)</sub>	Gate threshold voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250μA	-0.3	—	-1.0	V
		T <sub>J</sub> = 125°C	—	-0.44	—	
I <sub>DSS</sub>	Drain-to-Source leakage current	V <sub>DS</sub> = -16V, V <sub>GS</sub> = 0V	—	—	-1	μA
		T <sub>J</sub> = 125°C	—	—	-50	
I <sub>GSS</sub>	Gate-to-Source forward leakage	V <sub>GS</sub> = 8V	—	—	10	μA
		V <sub>GS</sub> = -8V	—	—	-10	
Q <sub>g</sub>	Total gate charge	I <sub>D</sub> = -4A, V <sub>DS</sub> =-10V, V <sub>GS</sub> = -4.5V	—	10	—	nC
Q <sub>gs</sub>	Gate-to-Source charge		—	0.77	—	
Q <sub>gd</sub>	Gate-to-Drain("Miller") charge		—	3.5	—	
t <sub>d(on)</sub>	Turn-on delay time	V <sub>GS</sub> =-4.5V, V <sub>DS</sub> =-10V, RGEN=3Ω,	—	10	—	
t <sub>r</sub>	Rise time		—	8.6	—	ns
t <sub>d(off)</sub>	Turn-Off delay time		—	29	—	
t <sub>f</sub>	Fall time		—	13	—	
C <sub>iss</sub>	Input capacitance	V <sub>GS</sub> = 0V, V <sub>DS</sub> =-10V, f = 1MHz	—	939	—	pF
C <sub>oss</sub>	Output capacitance		—	130	—	
C <sub>rss</sub>	Reverse transfer capacitance		—	111	—	

**Source-Drain Ratings and Characteristics**

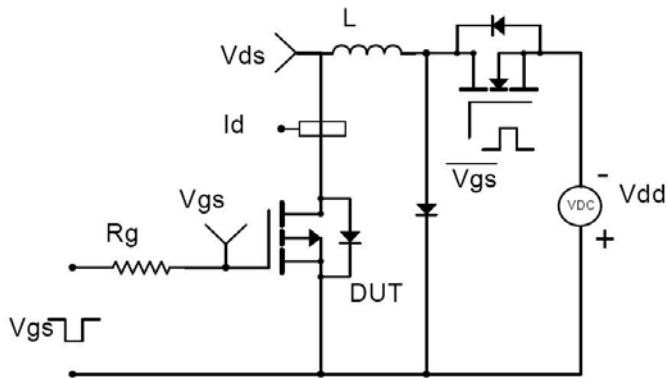
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
I <sub>S</sub>	Continuous Source Current (Body Diode)	MOSFET symbol showing the integral reverse p-n junction diode.	—	—	-4.2A ①	A
I <sub>SM</sub>	Pulsed Source Current (Body Diode)		—	—	-30	A
V <sub>SD</sub>	Diode Forward Voltage	I <sub>S</sub> =1A, V <sub>GS</sub> =0V	—	-0.76	-1.0	V
t <sub>rr</sub>	Reverse Recovery Time	T <sub>J</sub> = 25°C, I <sub>F</sub> =-4A, di/dt = 100A/μs	—	8.7	—	ns
Q <sub>rr</sub>	Reverse Recovery Charge		—	2.3	—	nC

**Notes:**

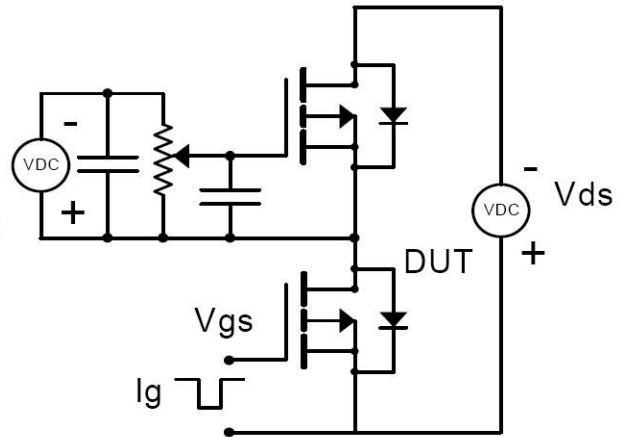
- ① Calculated continuous current based on maximum allowable junction temperature.
- ② Repetitive rating; pulse width limited by max. junction temperature.
- ③ The power dissipation PD is based on max. junction temperature, using junction-to-case thermal resistance.
- ④ The value of R<sub>θJA</sub> is measured with the device mounted on 1 in 2 FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub> =25°C

## Test circuits and Waveforms

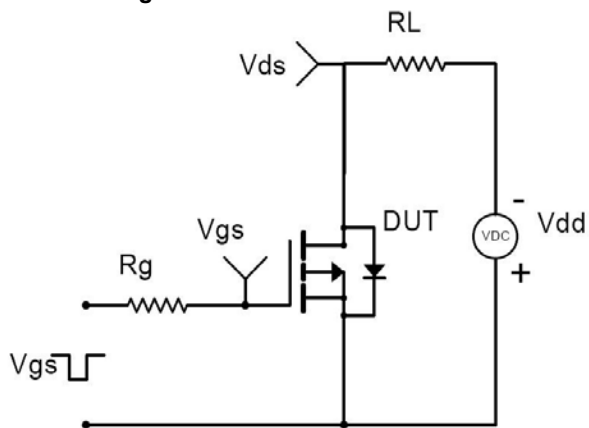
EAS test circuit:



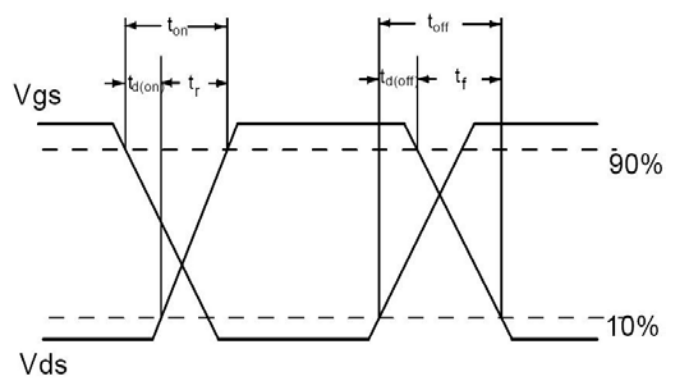
Gate charge test circuit:



Switching time test circuit:



Switch Waveforms:



Typical electrical and thermal characteristics

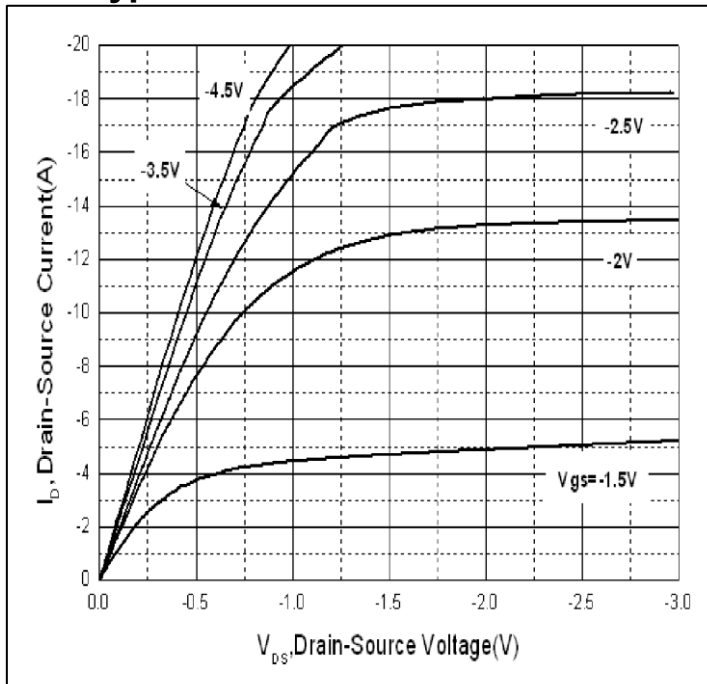


Figure 1: Typical Output Characteristics

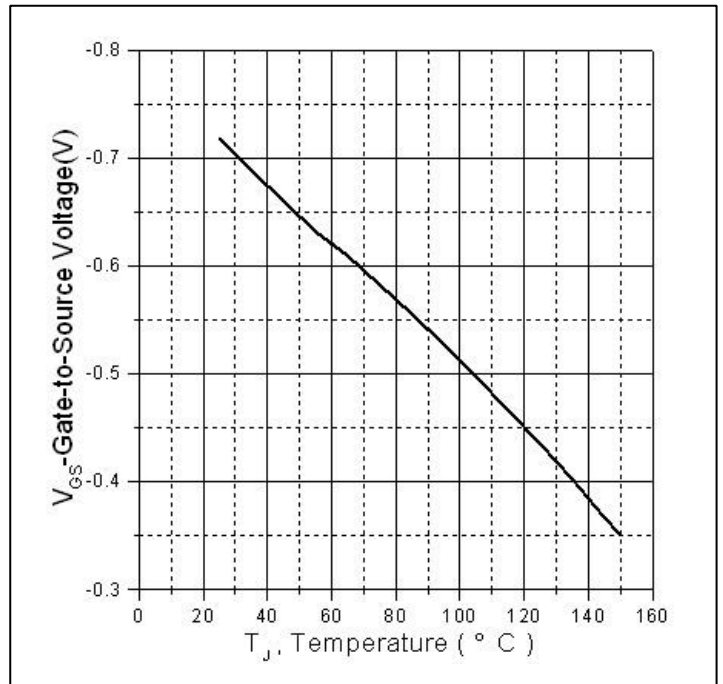


Figure 2. Gate to source cut-off voltage

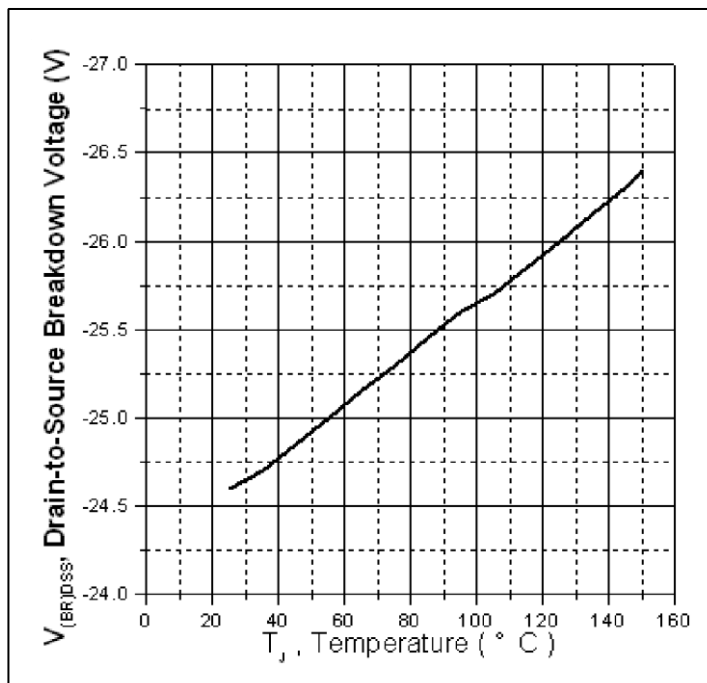


Figure 3. Drain-to-Source Breakdown Voltage Vs. Case Temperature

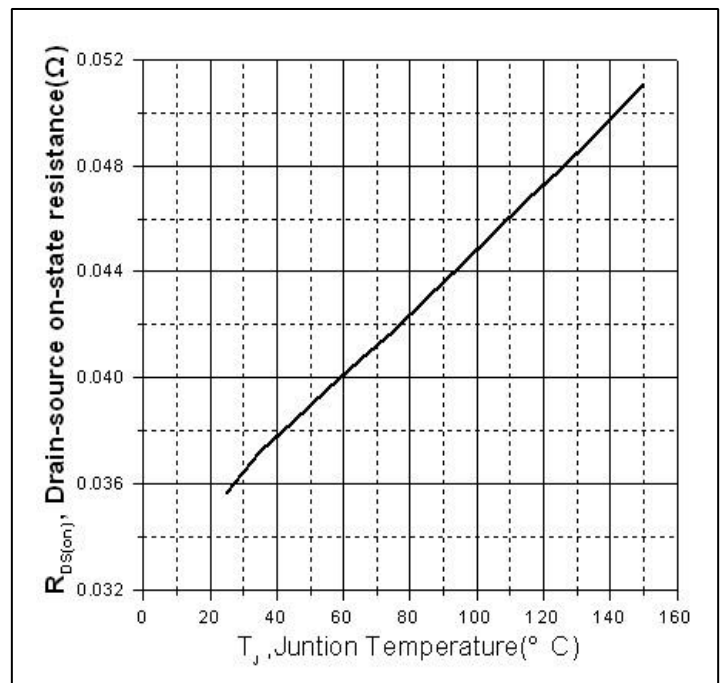
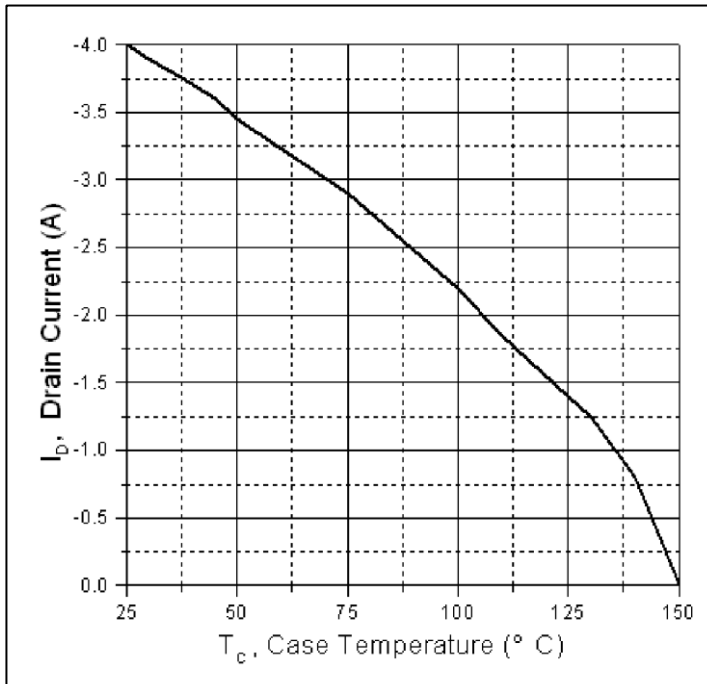
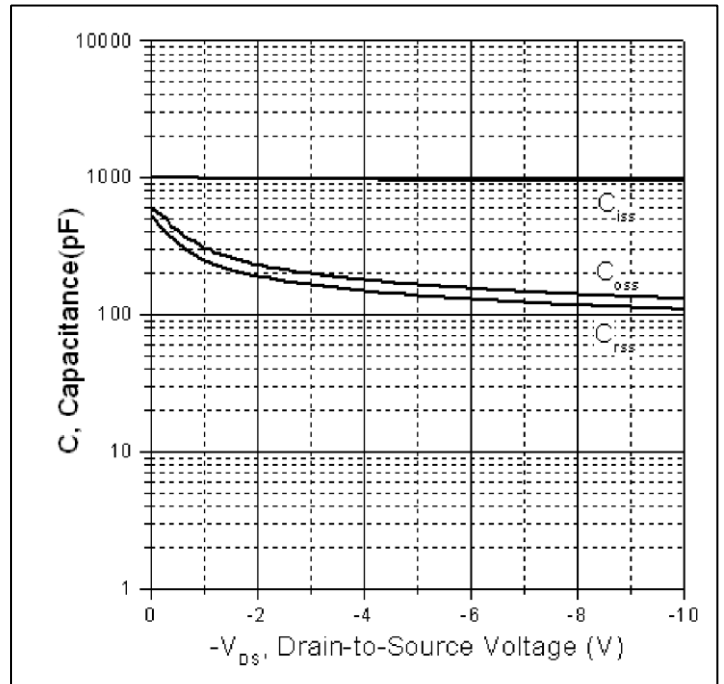


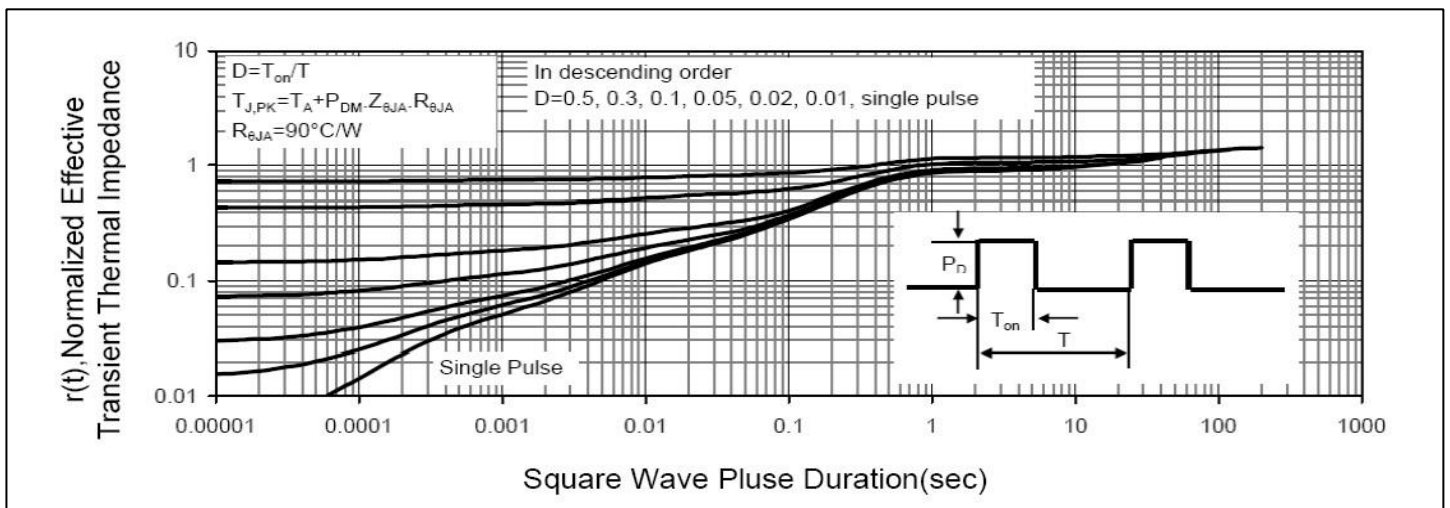
Figure 4: Normalized On-Resistance Vs. Case Temperature



**Figure 5. Maximum Drain Current Vs. Case Temperature**

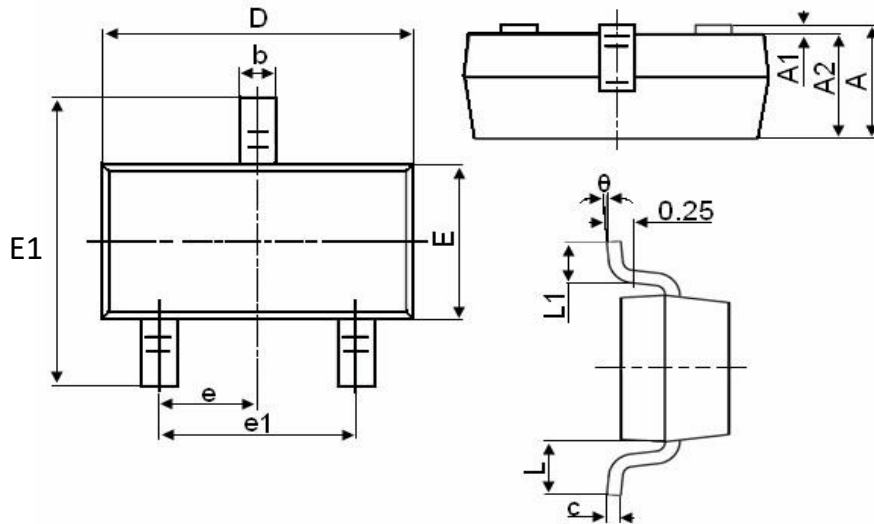


**Figure 6. Typical Capacitance Vs. Drain-to-Source Voltage**



**Figure 7. Maximum Effective Transient Thermal Impedance Junction-to-Case**

## Package Mechanical Data:SOT-23



Symbol	Dimensions in Millimeters	
	MIN.	MAX.
A	0.900	1.150
A1	0.000	0.100
A2	0.900	1.050
b	0.300	0.500
c	0.080	0.150
D	2.800	3.000
E	1.200	1.400
E1	2.250	2.550
e	0.950TYP	
e1	1.800	2.000
L	0.550REF	
L1	0.300	0.500
$\theta$	0°	8°