RECTRON SEMICONDUCTOR
TECHNICAL SPECIFICATION

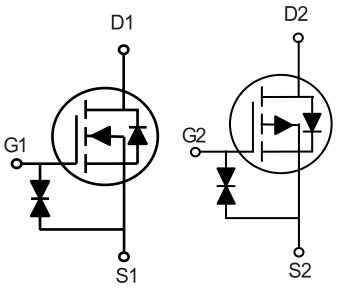
RM2020ES9

N and P-Channel Enhancement Mode Power MOSFET

Description

The RM2020ES9 uses advanced trench technology to provide excellent $R_{DS(ON)}$ and low gate charge . The complementary MOSFETs may be used to form a level shifted high side switch, and for a host of other applications.

Equivalent Circuit



General Features

- **N-Channel**

  V_{DS} = 20V,I_D =0.75A

  $R_{DS(ON)}$ < 380mΩ @ V_{GS}=4.5V

  $R_{DS(ON)}$ < 450 mΩ @ V_{GS}=2.5V

  $R_{DS(ON)}$ < 800 mΩ @ V_{GS}=1.8V

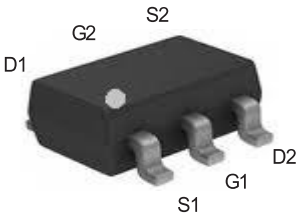
- **P-Channel**

  V_{DS} = -20V,I_D = -0.8A

  $R_{DS(ON)}$ < 800 mΩ @ V_{GS}=-4.5V

  $R_{DS(ON)}$ <1200mΩ @ V_{GS}=-2.5V

- High power and current handing capability
- Lead free product is acquired
- Surface mount package
- Halogen-free



SOT-363

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
2020	RM2020ES9	SOT-363-6L	Ø180mm	8mm	3000units

Absolute Maximum Ratings (T_A=25℃unless otherwise noted)

Parameter		Symbol	N-Channel	P-Channel	Unit
Drain-Source Voltage		V_{DS}	20	-20 (typ.-25)	V
Gate-Source Voltage		V_{GS}	±12	±12	V
Continuous Drain Current	T_A=25℃	I_D	0.75	-0.8	A
Pulsed Drain Current (Note 1)		I_{DM}	5	-4	A
Maximum Power Dissipation	T_A=25℃	P_D	0.15	0.8	W
Operating Junction and Storage Temperature Range		T_J,T_{STG}	-55 To 150	-55 To 150	℃

Thermal Characteristic

Thermal Resistance,Junction-to-Ambient	$R_{\theta JA}$	N-Ch	833	℃/W
Thermal Resistance,Junction-to-Ambient	$R_{\theta JA}$	P-Ch	156	℃/W

Electrical Characteristics (T_A =25 °C Unless Otherwise Noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_{DS} = -250 µA	-20	-	-	V
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_{DS} = -250 µA	-0.3	-0.65	-1.0	V
I_{DSS}	Drain Leakage Current	V_{DS} = -20 V, V_{GS} = 0 V	-	-	-1	µA
		T_J = 85 °C	-	-	-30	µA
I_{GSS}	Gate Leakage Current	V_{GS} = ± 8 V, V_{DS} = 0 V	-	-	± 10	µA
$R_{DS(ON)}$[a]	On-State Resistance	V_{GS} = -4.5 V, I_{DS} = -0.5 A	-	0.85	1.2	Ω
		V_{GS} = -2.5 V, I_{DS} = -0.2 A	-	1.05	1.5	
		V_{GS} = -1.5V , I_{DS} = -0.04A	-	1.5	-	
		V_{GS} = -1.2V , I_{DS} = -0.01A	-	2	-	
Diode Characteristics						
V_{SD}[a]	Diode Forward Voltage	I_{SD} = -0.5 A, V_{GS} = 0 V	-	-	1.3	V
t_{rr}	Reverse Recovery Time	I_{SD} = -0.5 A, dI_{SD} / dt = 100 A / µs	-	70	-	ns
Q_{rr}	Reverse Recovery Charge		-	68	-	nC
Dynamic Characteristics[b]						
C_{iss}	Input Capacitance	V_{GS} = 0 V, V_{DS} = -10 V Frequency = 1 MHz	-	87	-	pF
C_{oss}	Output Capacitance		-	15	-	
C_{rss}	Reverse Transfer Capacitance		-	8.2	-	
t_d(on)	Turn-on Delay Time	V_{DS} = -30 V, V_{GEN} = -10 V, R_G = 25 Ω, R_L = 60 Ω, I_{DS} = -0.67 A	-	5.6	-	ns
t_r	Turn-on Rise Time		-	5.3	-	
t_d(off)	Turn-off Delay Time		-	30	-	
t_f	Turn-off Fall Time		-	21	-	
Q_g	Total Gate Charge	V_{GS} = -4.5 V, V_{DS} = -10 V, I_{DS} = -0.67 A	-	1.8	-	nC
Q_{gs}	Gate-Source Charge		-	0.82	-	
Q_{gd}	Gate-Drain Charge		-	0.59	-	

Notes :

a : Pulse test ; pulse width ≤ 300 µs, duty cycle ≤ 2 %

b : Guaranteed by design, not subject to production testing

MOSFET ELECTRICAL CHARACTERISTICS T_a=25℃ unless otherwise specified

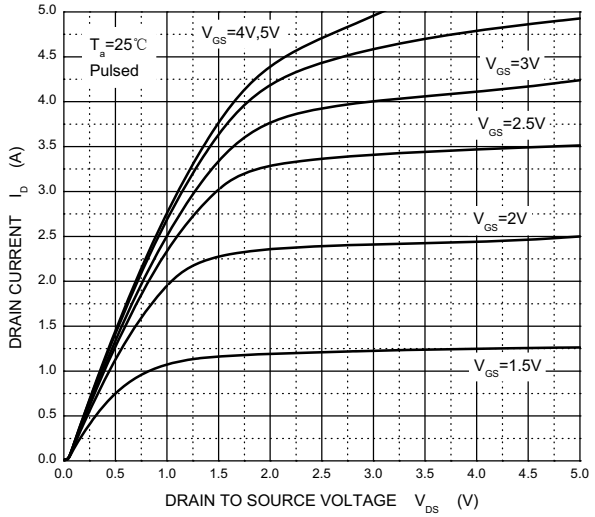
Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
STATIC PARAMETERS						
Drain-source breakdown voltage	$V_{(BR)\ DSS}$	V_{GS} = 0V, I_D =250μA	20			V
Zero gate voltage drain current	I_{DSS}	V_{DS} =20V,V_{GS} = 0V			1	μA
Gate-body leakage current	I_{GSS}	V_{GS} =±10V, V_{DS} = 0V			±20	μA
Gate threshold voltage (note 1)	$V_{GS(th)}$	V_{DS} =V_{GS}, I_D =250μA	0.35	0.54	1.1	V
Drain-source on-resistance (note 1)	$R_{DS(on)}$	V_{GS} =4.5V, I_D =0.65A		270	380	mΩ
		V_{GS} =2.5V, I_D =0.55A		320	450	mΩ
		V_{GS} =1.8V, I_D =0.45A		390	800	mΩ
Forward tranconductance (note 1)	g_{FS}	V_{DS} =10V, I_D =0.8A		1.6		S
Diode forward voltage(note 1)	V_{SD}	I_S=0.15A, V_{GS} = 0V			1.2	V
DYNAMIC PARAMETERS (note 2)						
Input Capacitance	C_{iss}	V_{DS} =16V,V_{GS} =0V,f =1MHz		79	120	pF
Output Capacitance	C_{oss}			13	20	pF
Reverse Transfer Capacitance	C_{rss}			9	15	pF
SWITCHING PARAMETERS(note 2)						
Turn-on delay time	$t_{d(on)}$	V_{GS}=4.5V,V_{DS}=10V, I_D=0.5A,R_{GEN}=10Ω		6.7		ns
Turn-on rise time	t_r			4.8		ns
Turn-off delay time	$t_{d(off)}$			17.3		ns
Turn-off fall time	t_f			7.4		ns
Total Gate Charge	Q_g	V_{DS} =10V,V_{GS} =4.5V,I_D =0.25A		1.2		nC
Gate-Source Charge	Q_{gs}			0.28		nC
Gate-Drain Charge	Q_{gd}			0.2		nC

Notes :

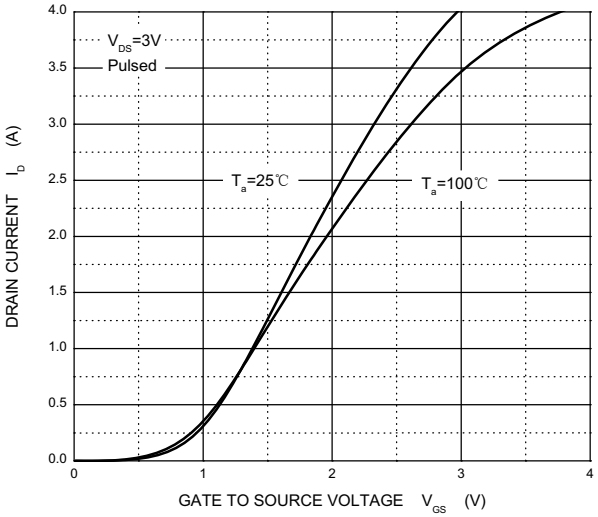
1. Pulse Test : Pulse width≤300μs, duty cycle≤0.5%.
2. Guaranteed by design, not subject to production testing.

N-TypicalCharacteristics

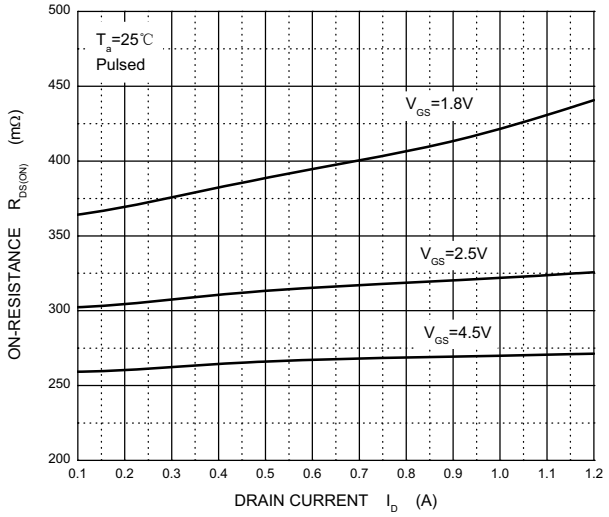
Output Characteristics



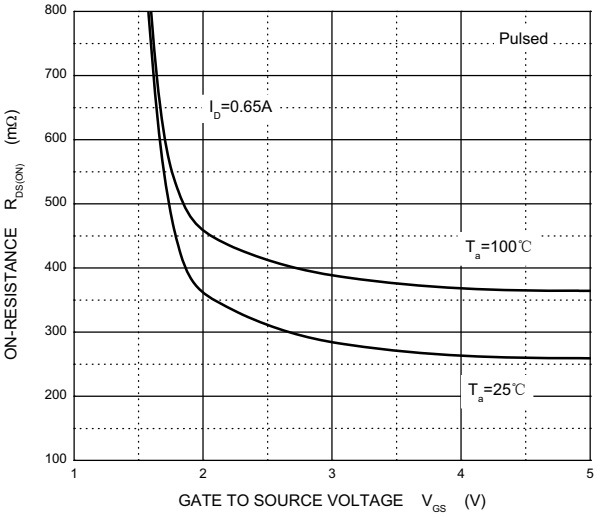
Transfer Characteristics



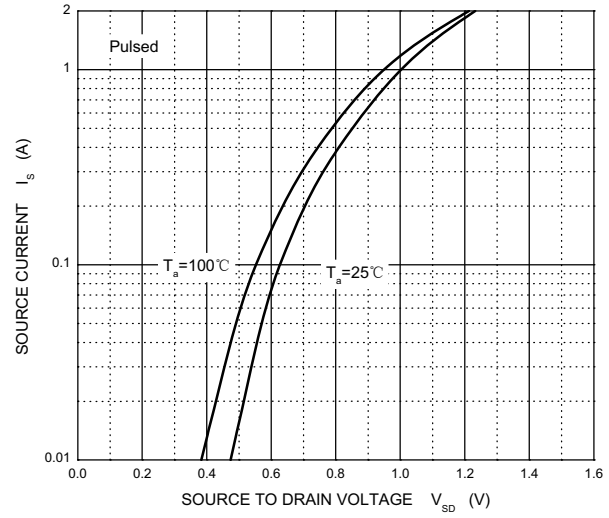
$R_{DS(ON)}$ —— I_D



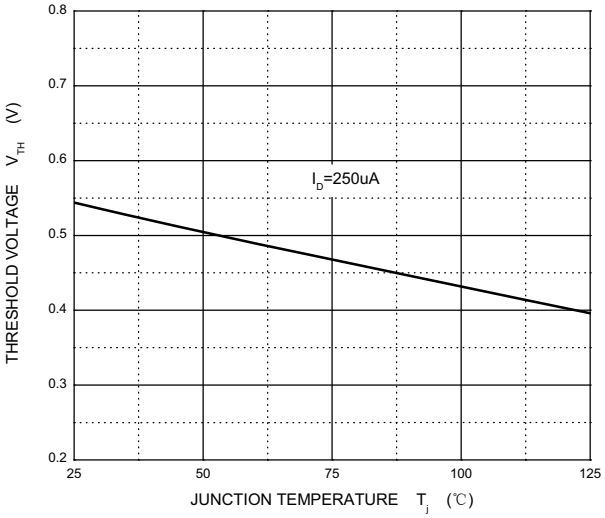
$R_{DS(ON)}$ —— V_{GS}



I_S —— V_{SD}

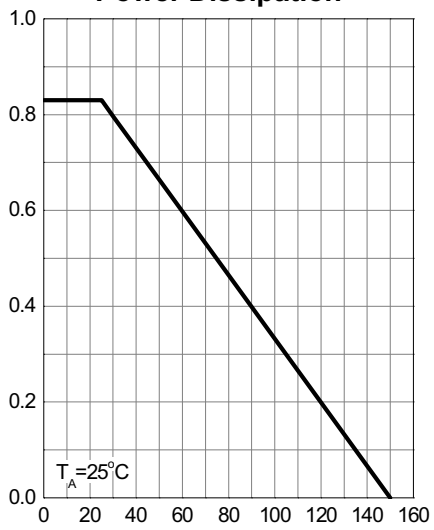


Threshold Voltage



P-Typical Characteristics

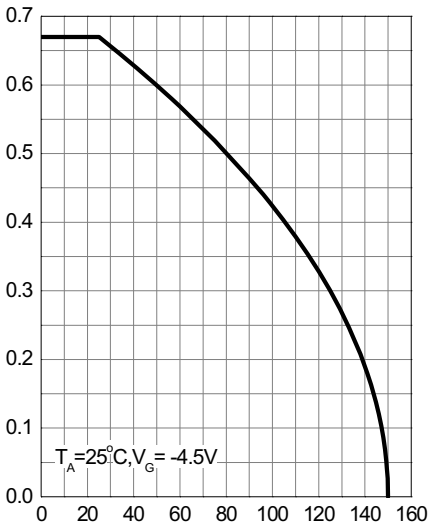
Power Dissipation



P_{tot} - Power (W)

T_j - Junction Temperature (˚C)

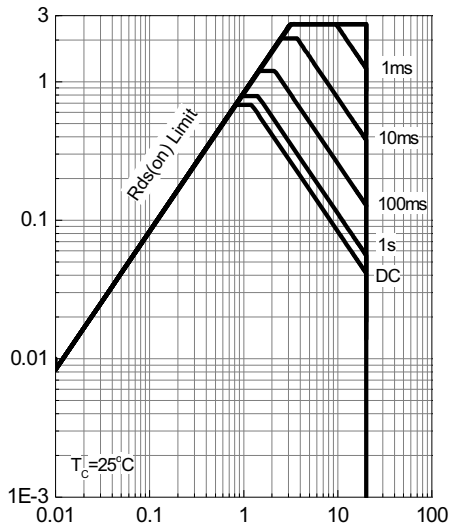
Drain Current



I_D - Drain Current (A)

T_j - Junction Temperature (˚C)

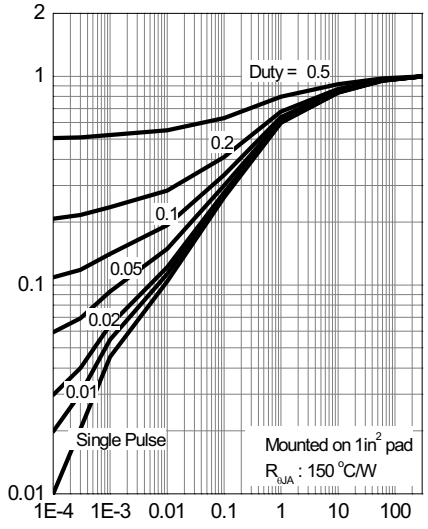
Safe Operation Area



I_D - Drain Current (A)

$-V_{DS}$ - Drain-Source Voltage (V)

Thermal Transient Impedance

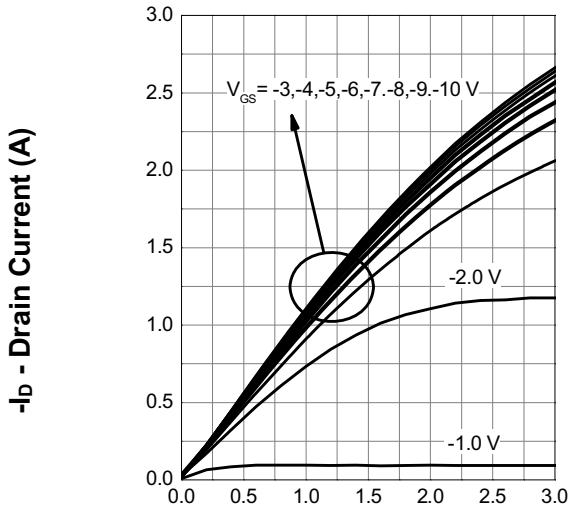


Normalized Effective Transient

Square Wave Pulse Duration (sec)

P-Typical Characteristics

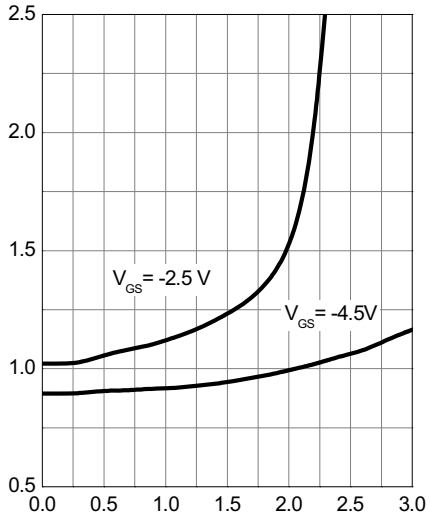
Output Characteristics



$-I_D$ - Drain Current (A)

$-V_{DS}$ - Drain-Source Voltage (V)

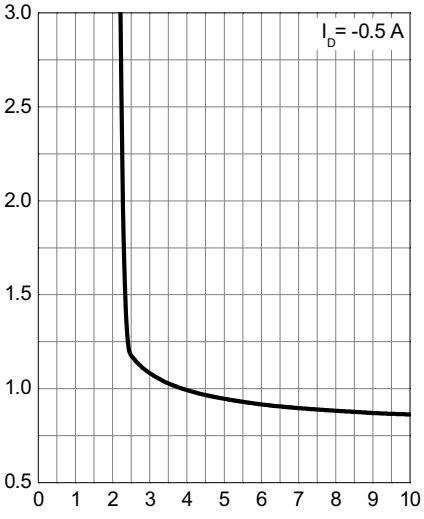
Drain-Source On Resistance



$R_{DS(ON)}$ - On Resistance (Ω)

$-I_D$ - Drain Current (A)

Transfer Characteristics



$R_{DS(ON)}$ - On Resistance (Ω)

$-V_{GS}$ - Gate-Source Voltage (V)

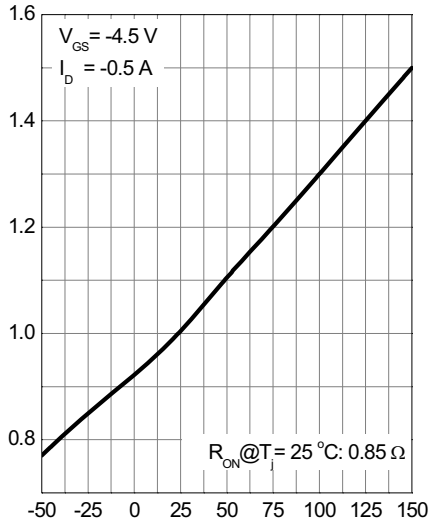
Gate Threshold Voltage

Normalized Threshold Voltage

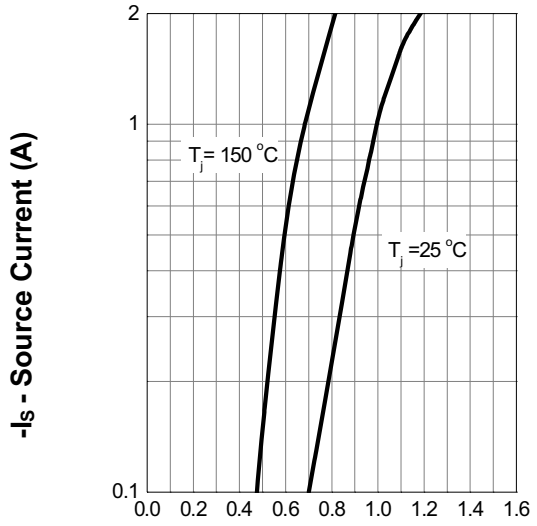
T_j - Junction Temperature (°C)

P-Typical Characteristics

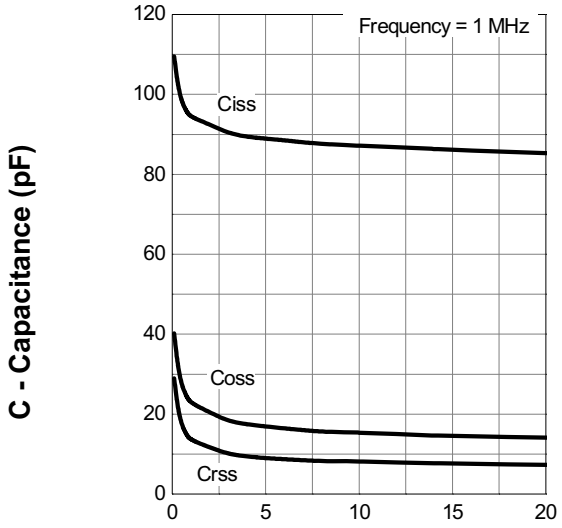
Drain-Source On Resistance



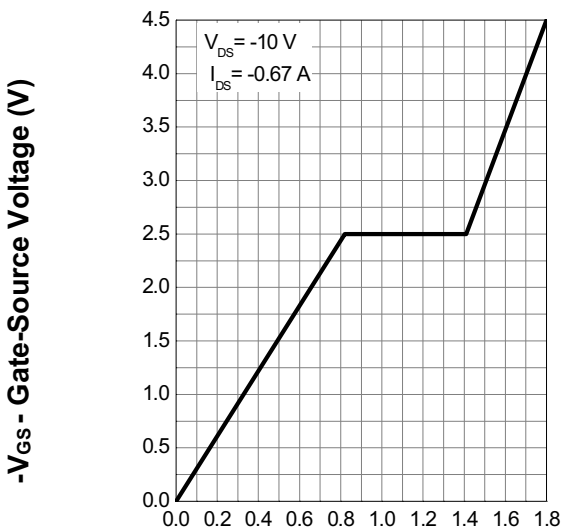
Source-Drain Diode Forward



Capacitance

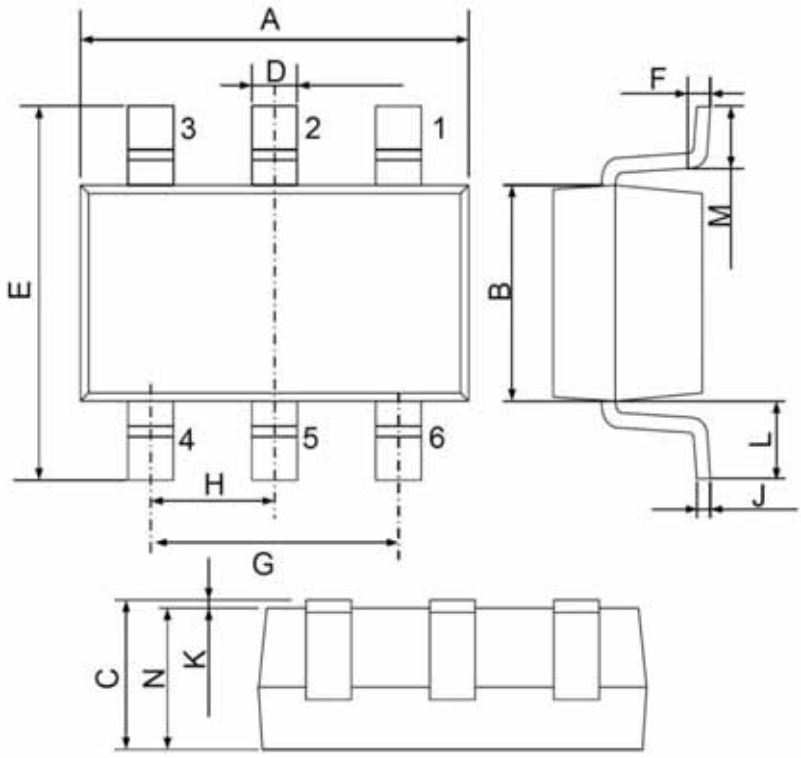


Gate Charge



Package Dimensions

SOT-363-6L



UNIT: mm

DIM	MIN	MAX
A	2.00	2.20
B	1.15	1.35
C	0.90	1.10
D	0.15	0.35
E	2.15	2.45
F	0.20 Typ.	
G	1.20	1.40
H	0.65 Typ.	
J	0.08	0.15
K	0.00	0.10
L	0.525 Ref.	
M	0.26	0.46
N	0.90	1.00

PKG	tape	Reel	Box	pcs/reel	reel/box	pcs/box	box/carton	pcs/carton
SOT-363	IC-ZD-05	7” (IC-JP-05)	SOT363	3000	10	30000	4	120000

DISCLAIMER NOTICE

Rectron Inc reserves the right to make changes without notice to any product specification herein, to make corrections, modifications, enhancements or other changes. Rectron Inc or anyone on its behalf assumes no responsibility or liability for any errors or inaccuracies. Data sheet specifications and its information contained are intended to provide a product description only. "Typical" parameters which may be included on RECTRON data sheets and/ or specifications can and do vary in different applications and actual performance may vary over time. Rectron Inc does not assume any liability arising out of the application or use of any product or circuit.

Rectron products are not designed, intended or authorized for use in medical, life-saving implant or other applications intended for life-sustaining or other related applications where a failure or malfunction of component or circuitry may directly or indirectly cause injury or threaten a life without expressed written approval of Rectron Inc. Customers using or selling Rectron components for use in such applications do so at their own risk and shall agree to fully indemnify Rectron Inc and its subsidiaries harmless against all claims, damages and expenditures.