



**WANSEMI**  
万芯半导体

**WP4024R**

# **Enhancement Mode N+P-Channel Power MOSFET**

PDFN5x6/N+PMOS/40V/ $\pm 20$ V/1.7V/20A/13.5m $\Omega$

-40V/ $\pm 20$ V/-1.8V/-20A/33m $\Omega$

Rev0.6

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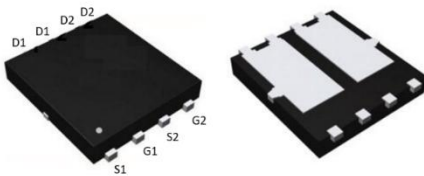
## 40V N+P-Channel MOSFET

### 1.Features

- ◆ High power and current handling capability
- ◆ Lead free product is acquired
- ◆ Fast switching
- ◆ Surface mount package

### 2.Applications

- ◆ DC motor
- ◆ PWM applications



PDFN5x6

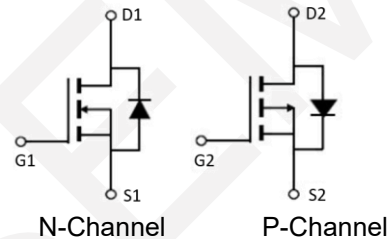
Pin Description

#### ◆ N-Channel

$V_{DS}$	$R_{DS(on)}$ Typ.	$I_D$
40V	13.5m $\Omega$ @ 10V	20A
	17.5m $\Omega$ @ 4.5V	

#### ◆ P-Channel

$V_{DS}$	$R_{DS(on)}$ Typ.	$I_D$
-40V	33m $\Omega$ @ -10V	-20A
	40m $\Omega$ @ -4.5V	



Schematic Diagram

### 3.Package Marking and Ordering Information

Part no.	Marking	Package	PCS/Tube	PCS/CTN.
WP4024R	WP4024R	PDFN5X6	5,000	50,000

### 4.Absolute Max Ratings at Ta=25°C (Note1)

Parameter	Symbol	N-channel	P-channel	Units
Drain to Source Voltage	$V_{DSS}$	40	-40	V
Gate to Source Voltage	$V_{GSS}$	$\pm 20$	$\pm 20$	V
Drain Current (DC)	$I_D$	20	-20	A
Drain Current (Pulse), $PW \leq 300\mu s$	$I_{DM}$	80	-60	A
Total Dissipation	$P_D$	21		W
Avalanche Energy, Single Pulsed	$E_{AS}$	44.89		mJ
Junction Temperature	$T_j$	-55 to +175		$^{\circ}C$
Storage Temperature	$T_{stg}$			

Note 1: Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

**5. Thermal Resistance Ratings (Note 2)**

Parameter	Symbol	N-channel	P-channel	Unit
Maximum Junction-to-Ambient	$R_{\theta JA}$	32	7	$^{\circ}\text{C}/\text{W}$

Note 2: When mounted on 1 inch square copper board  $t \leq 10\text{sec}$  The value in any given application depends on the user's specific board design.

**6. Electrical Characteristics at  $T_a=25^{\circ}\text{C}$  (Note 3)**
**N-Channel**

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Drain to Source Breakdown Voltage	$V_{(BR)DSS}$	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}$	40	-	-	V
Zero-Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 40\text{V}, V_{GS} = 0\text{V}$	-	-	1	$\mu\text{A}$
Gate to Source Leakage Current	$I_{GSS}$	$V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$	-	-	$\pm 100$	nA
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_{DS}=250\mu\text{A}$	1.0	1.7	2.5	V
Static Drain to Source On-State Resistance	$R_{DS(on)}$	$I_D = 20\text{A}, V_{GS} = 10\text{V}$	-	13.5	18	$\text{m}\Omega$
		$I_D = 10\text{A}, V_{GS} = 4.5\text{V}$	-	17.5	29	$\text{m}\Omega$
Input Capacitance	$C_{iss}$	$V_{GS}=0\text{V},$ $V_{DS}=20\text{V},$ Frequency=1.0MHz	-	1174	-	pF
Output Capacitance	$C_{oss}$		-	162	-	pF
Reverse Transfer Capacitance	$C_{rss}$		-	130	-	pF
Turn-ON Delay Time	$t_{d(on)}$	$V_{DD} = 20\text{V}$ $V_{GS} = 10\text{V}$ $R_G = 3\Omega$ $R_L = 2.5\Omega$	-	7	-	ns
Rise Time	$t_r$		-	15	-	ns
Turn-OFF Delay Time	$t_{d(off)}$		-	25	-	ns
Fall Time	$t_f$		-	6	-	ns
Total Gate Charge	$Q_g$	$V_{DS} = 20\text{V},$	-	23	-	nC
	$Q_{gs}$	$V_{GS} = 10\text{V},$	-	4.5	-	nC
	$Q_{gd}$	$I_D = 20\text{A}$	-	2.5	-	nC
Diode Forward Voltage	$V_{FSD}$	$I_S = 20\text{A}, V_{GS} = 0\text{V}$	-	-	1.2	V

**P-Channel**

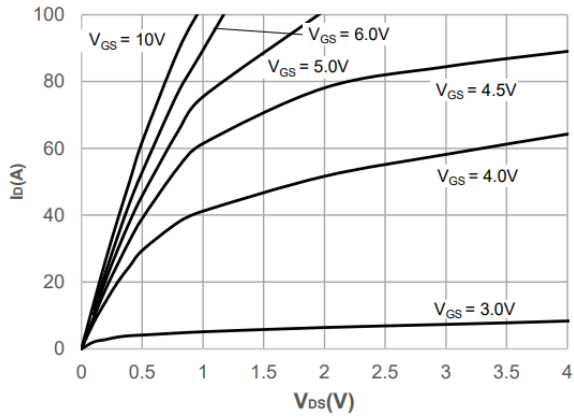
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Drain to Source Breakdown Voltage	$V_{(BR)DSS}$	$I_D = -250\mu A, V_{GS} = 0V$	-40	-	-	V
Zero-Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -40V, V_{GS} = 0V$	-	-	-1	$\mu A$
Gate to Source Leakage Current	$I_{GSS}$	$V_{GS} = \pm 20V, V_{DS} = 0V$	-	-	$\pm 100$	nA
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_{DS}=-250\mu A$	-1.0	-1.8	-2.5	V
Static Drain to Source On-State Resistance	$R_{DS(on)}$	$I_D = -20A, V_{GS} = -10V$	-	33	45	m $\Omega$
		$I_D = -10A, V_{GS} = -4.5V$	-	40	58	m $\Omega$
Input Capacitance	$C_{iss}$	$V_{GS}=0V,$ $V_{DS}=-20V,$ Frequency=1.0MHz	-	1243	-	pF
Output Capacitance	$C_{oss}$		-	97	-	pF
Reverse Transfer Capacitance	$C_{rss}$		-	80	-	pF
Turn-ON Delay Time	$t_{d(on)}$	$V_{DD} = -20V$ $V_{GS} = -10V$ $R_{GEN} = 3\Omega,$ $R_L = 1.5\Omega,$	-	5	-	ns
Rise Time	$t_r$		-	2	-	ns
Turn-OFF Delay Time	$t_{d(off)}$		-	51	-	ns
Fall Time	$t_f$		-	29	-	ns
Total Gate Charge	$Q_g$	$V_{DS} = -20V,$ $V_{GS} = -10V,$ $I_D = -20A$	-	23	-	nC
	$Q_{gs}$		-	4	-	nC
	$Q_{gd}$		-	4	-	nC
Diode Forward Voltage	$V_{FSD}$	$I_S = -20A, V_{GS} = 0V$	-	-	-1.2	V

Note 3: Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

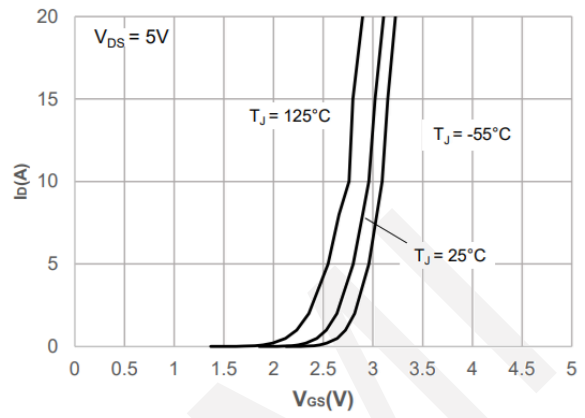


## 7. Typical electrical and thermal characteristics

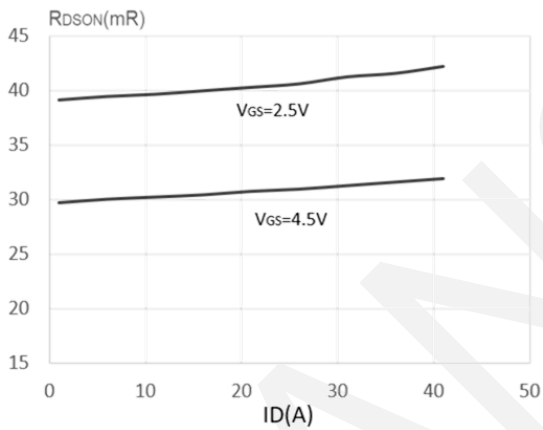
### N-Channel



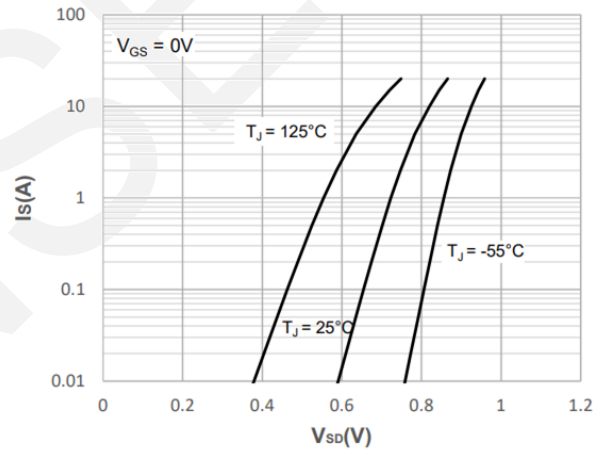
Output Characteristics



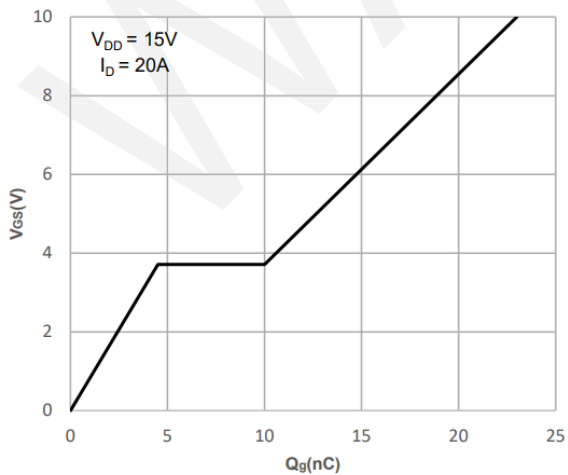
Transfer Characteristics



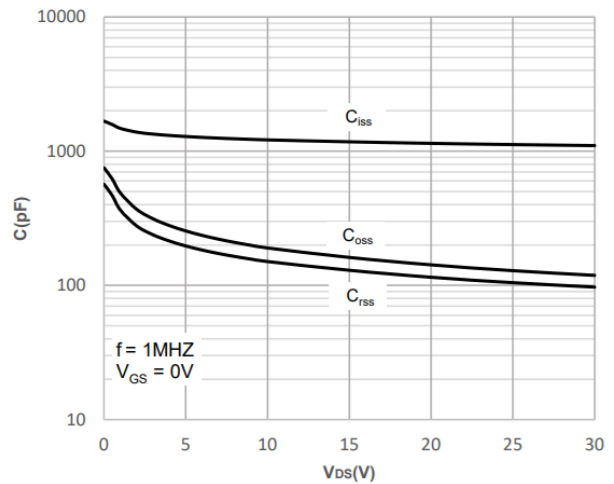
On-resistance vs. Drain Current



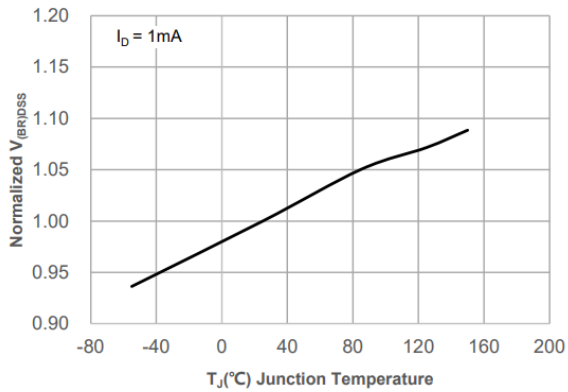
Body Diode Characteristics



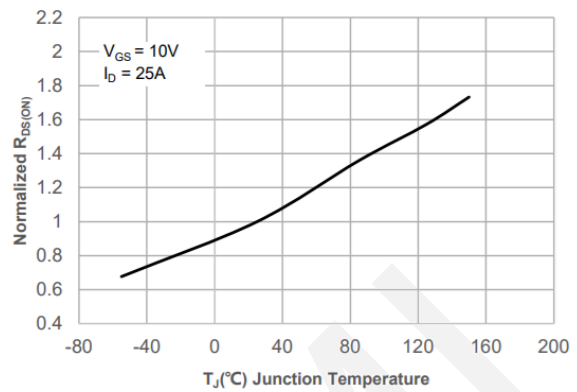
Gate Charge Characteristics



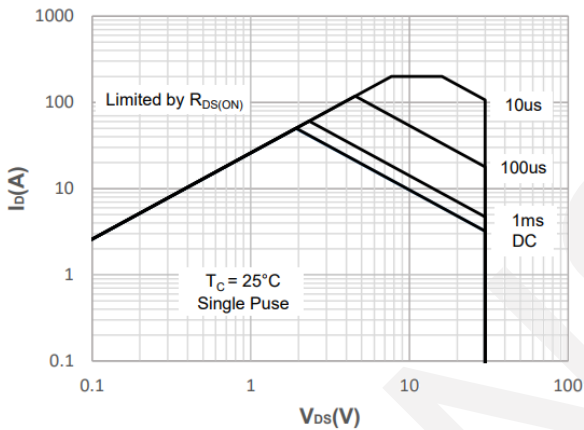
Capacitance Characteristics



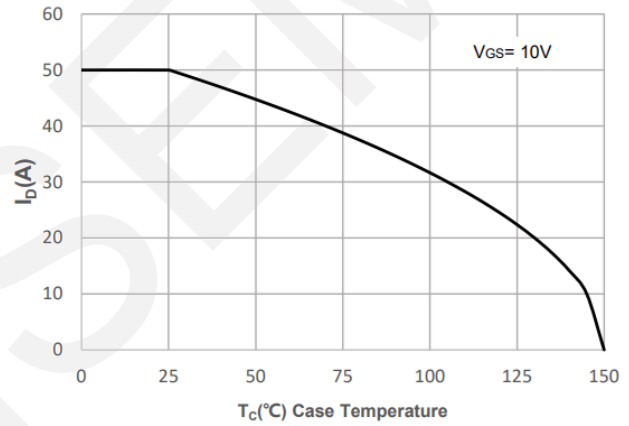
Normalized Breakdown Voltage vs. Junction Temperature



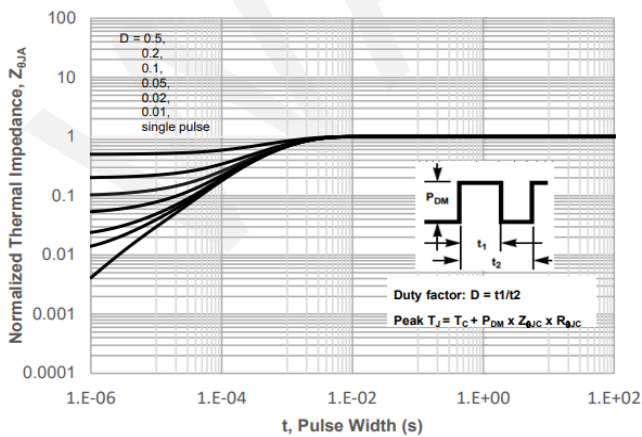
Normalized on Resistance vs. Junction Temperature



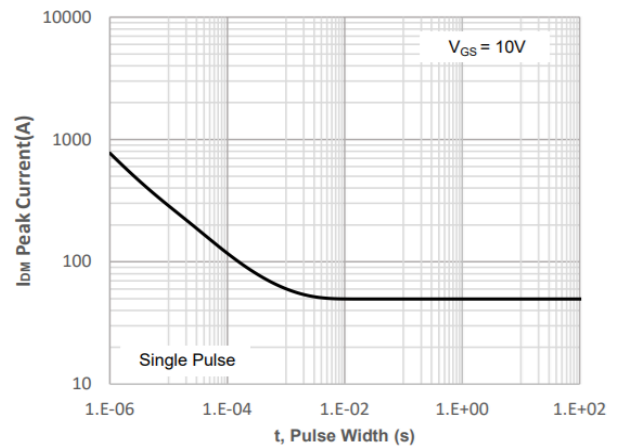
Maximum Safe Operating Area



Maximum Continuous Drain Current vs. Case Temperature



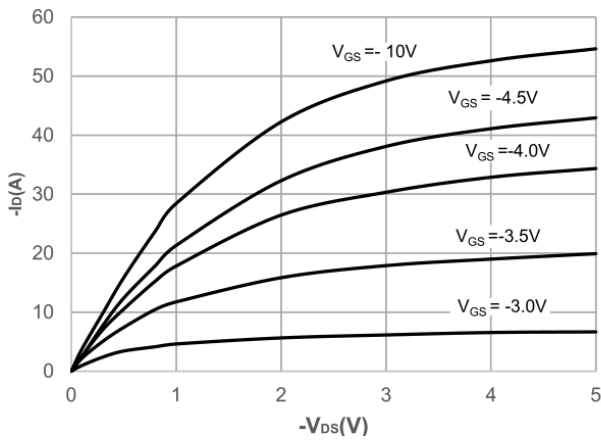
Normalized Maximum Transient Thermal Impedance



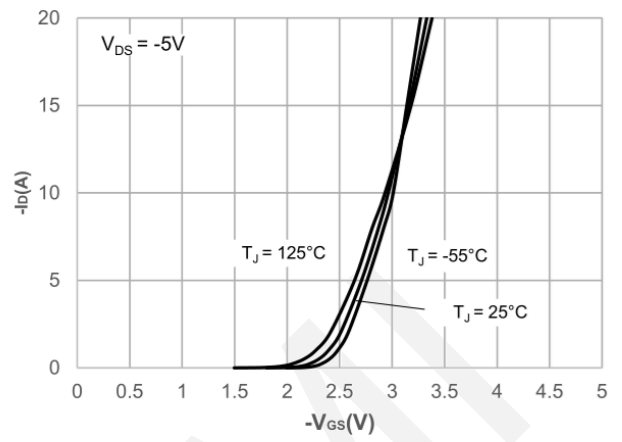
Peak Current Capacity



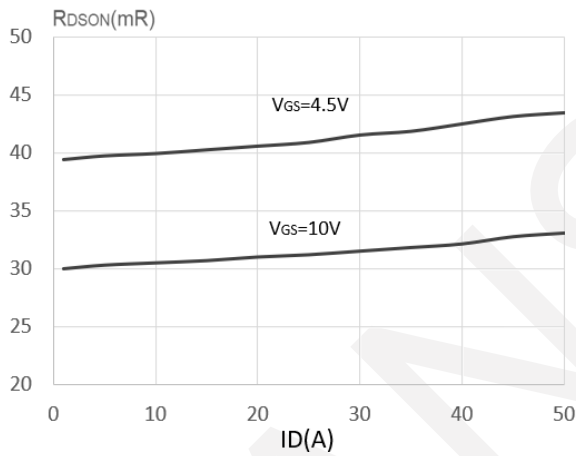
P-Channel



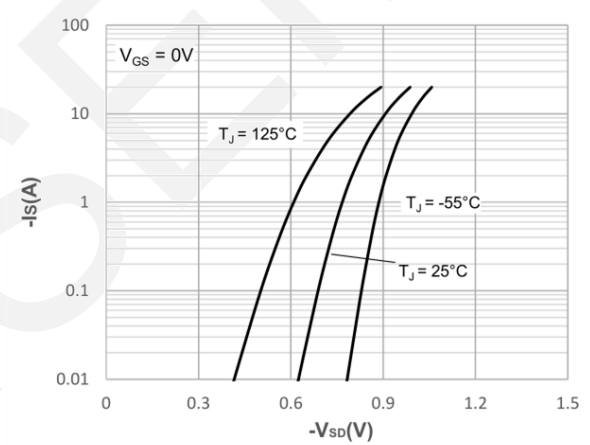
Output Characteristics



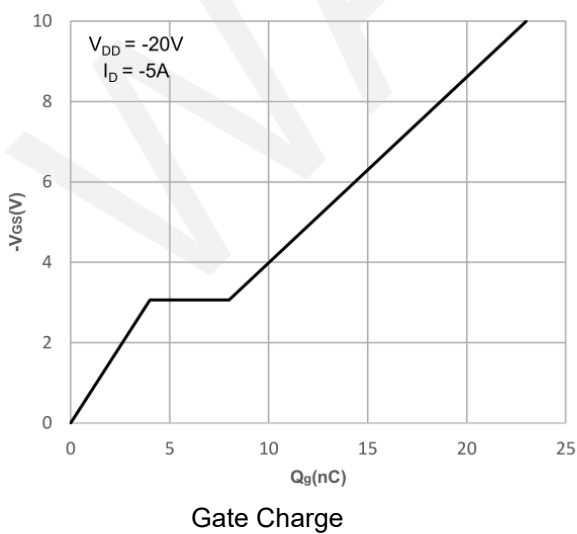
Transfer Characteristics



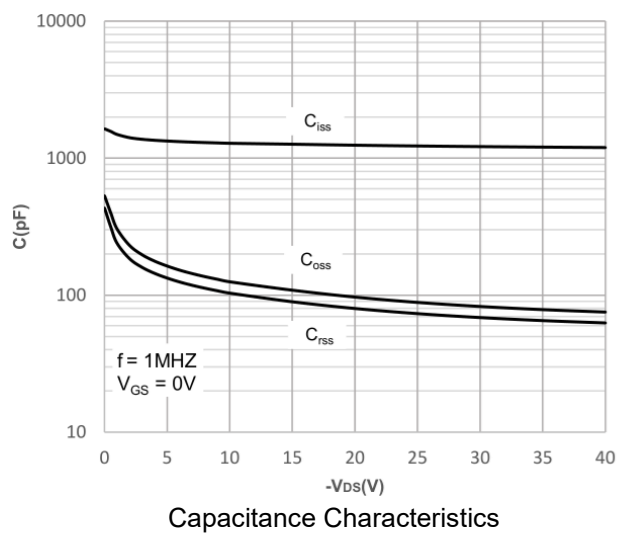
Rdson- Drain Current



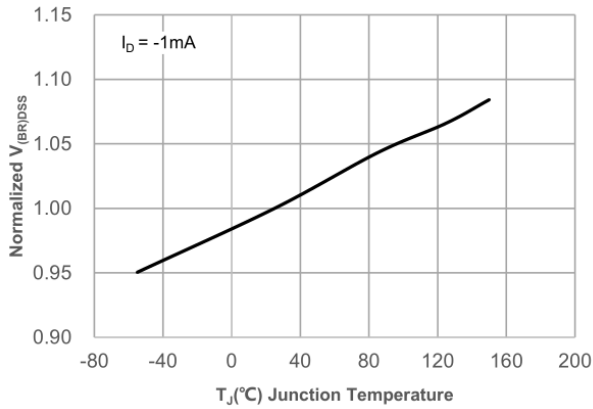
Body Diode Characteristics



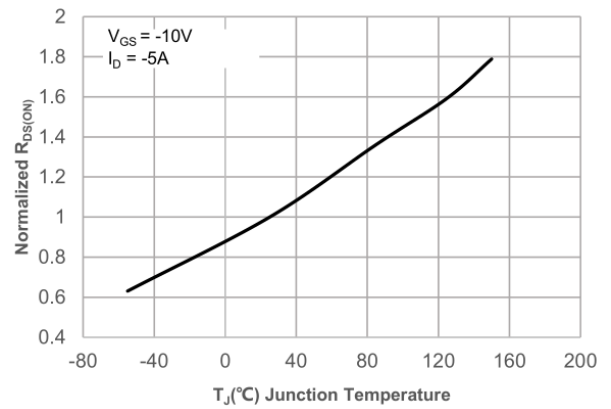
Gate Charge



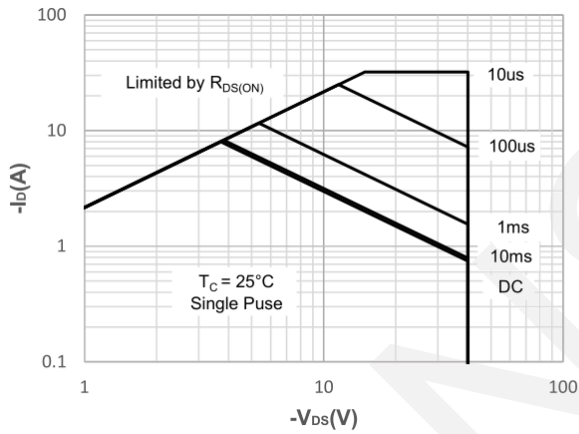
Capacitance Characteristics



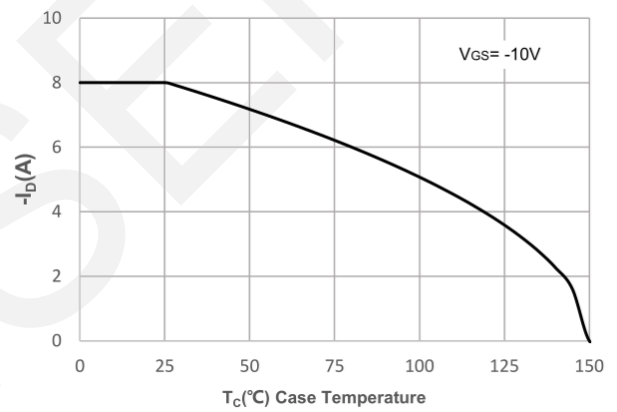
Normalized Breakdown voltage vs. Junction Temperature



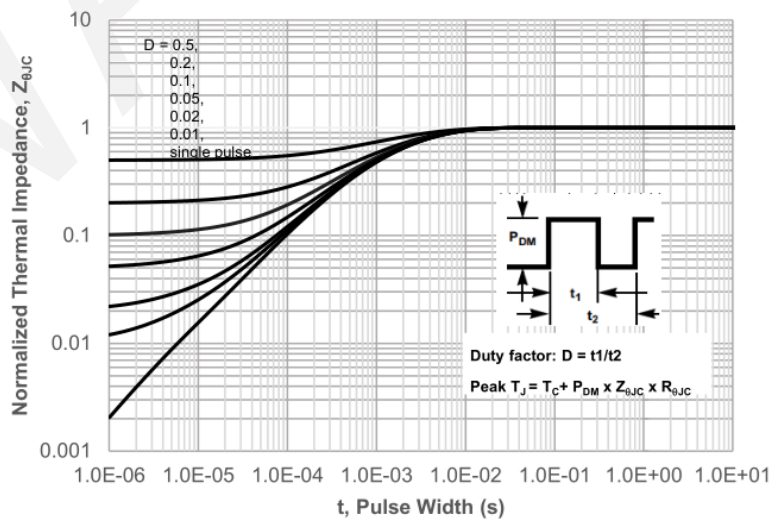
Normalized on Resistance vs. Junction Temperature



Maximum Safe Operating Area



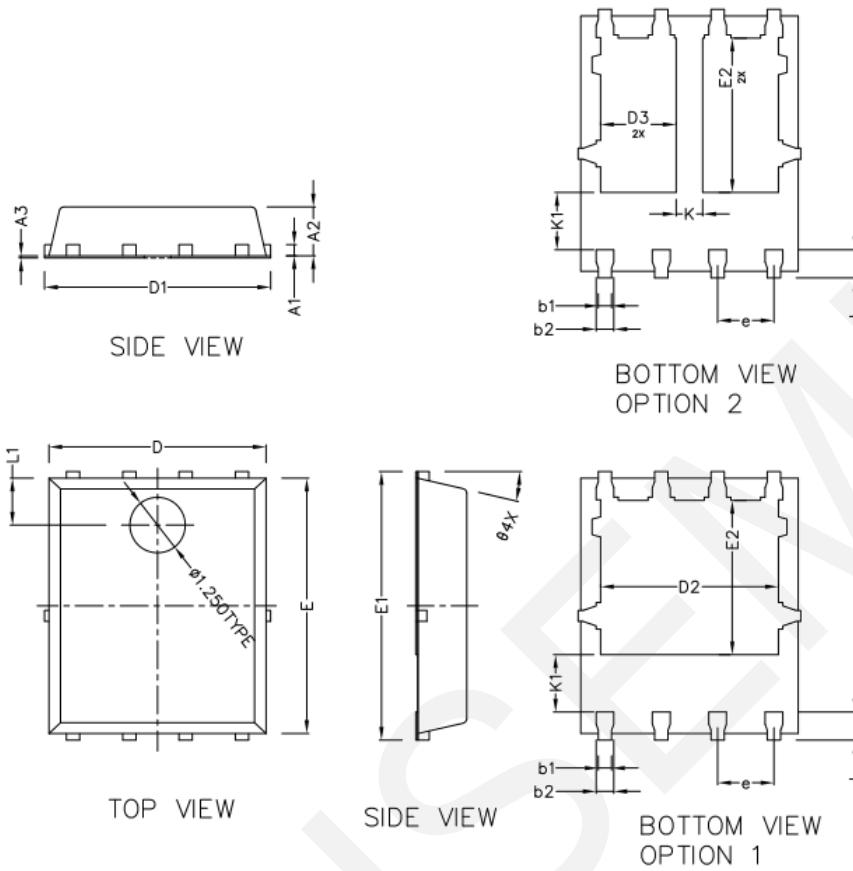
Maximum Continuous Driian Current vs. Case Temperature



Normalized Maximum Transient Thermal Impedance



**8.Package Dimensions**



COMMON DIMENSIONS (UNITS OF MEASURE IS mm)			
	MIN	NORMAL	MAX
A1	0.254 BSC		
A2	1.000	1.100	1.200
A3	0.005	—	0.020
b1	0.250	0.300	0.350
b2	0.350	0.400	0.450
D	4.800	4.900	5.000
D1	5.000	5.100	5.200
D2	3.910	4.010	4.110
D3	1.605	1.705	1.805
E	5.650	5.750	5.850
E1	5.950	6.050	6.150
E2	3.375	3.475	3.575
e	1.270 TYPE		
L	0.530	0.630	0.730
L1	1.00REF		
$\theta$	13° TYPE		
K	0.600 REF		
K1	1.235 REF		

## 9. Important Notice

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