

# ±30V, 57A&-44A, 10.9mΩ&15.7mΩ N And P-channel Power Trench MOSFET

## JMTG020C03D

### Features

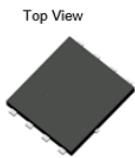
- Excellent  $R_{DS(ON)}$  and Low Gate Charge
- 100% UIS Tested
- 100%  $\Delta V_{ds}$  Tested
- Halogen-free; RoHS-compliant

### Applications

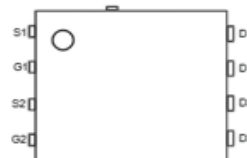
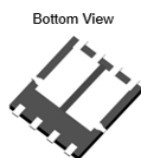
- Load Switch
- PWM Application
- Power Management

### Product Summary

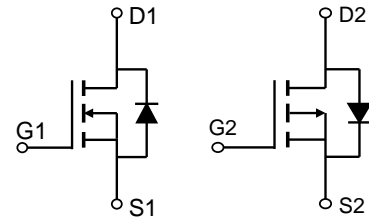
Parameters	N	P	Unit
$V_{DSS}$	30	-30	V
$V_{GS(th\_Typ)}$	1.6	1.6	V
$I_D(@V_{GS}=10V)$	57	-44	A
$R_{DS(ON\_Typ)}(@V_{GS}=10V)$	7.8	11.6	mΩ
$R_{DS(ON\_Typ)}(@V_{GS}=4.5V)$	10.9	15.7	mΩ



PDFN5x6-8L-D



Pin Assignment



Schematic Diagram

### Ordering Information

Device	Marking	MSL	Form	Package	Reel(pcs)	Per Carton (pcs)
JMTG020C03D	G020C03D	1	Tape&Reel	PDFN5x6-8L-D	5000	50000

### Absolute Maximum Ratings (@ $T_C = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Value-N	Value-P	Unit
$V_{DS}$	Drain-to-Source Voltage	30	-30	V
$V_{GS}$	Gate-to-Source Voltage	±20		V
$I_D$	Continuous Drain Current	$T_C = 25^\circ\text{C}$	57	-44
		$T_C = 100^\circ\text{C}$	36	-28
$I_{DM}$	Pulsed Drain Current <sup>(1)</sup>	Refer to Fig.4		A
$E_{AS}$	Single Pulsed Avalanche Energy <sup>(2)</sup>	35	71	mJ
$P_D$	Power Dissipation	$T_C = 25^\circ\text{C}$	55	47
		$T_C = 100^\circ\text{C}$	22	19
$T_J, T_{STG}$	Junction & Storage Temperature Range	-55 to 150		$^\circ\text{C}$

### Thermal Characteristics

Symbol	Parameter	Max		Unit
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient <sup>(3)</sup>	59	60	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction to Case	2.3	2.6	

**Electrical Characteristics-N**( $T_J = 25^\circ\text{C}$  unless otherwise specified)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
<b>Off Characteristics</b>						
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}$	30	-	-	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 30\text{V}, V_{GS} = 0\text{V}$	-	-	1.0	$\mu\text{A}$
$I_{GSS}$	Gate-Body Leakage Current	$V_{DS} = 0\text{V}, V_{GS} = \pm 20\text{V}$	-	-	$\pm 100$	nA
<b>On Characteristics</b>						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$	1.1	1.6	2.1	V
$R_{DS(ON)}$	Static Drain-Source ON-Resistance <sup>(4)</sup>	$V_{GS} = 10\text{V}, I_D = 20\text{A}$	-	7.8	10.1	m $\Omega$
		$V_{GS} = 4.5\text{V}, I_D = 10\text{A}$	-	10.9	14.2	m $\Omega$
<b>Dynamic Characteristics</b>						
$R_g$	Gate Resistance	$f = 1\text{MHz}$	-	2.7	-	$\Omega$
$C_{iss}$	Input Capacitance	$V_{GS} = 0\text{V}, V_{DS} = 15\text{V}, f = 1\text{MHz}$	-	1095	1642	pF
$C_{oss}$	Output Capacitance		-	126	252	pF
$C_{riss}$	Reverse Transfer Capacitance		-	104	208	pF
$Q_g$	Total Gate Charge	$V_{GS} = 0 \text{ to } 10\text{V}$ $V_{DS} = 15\text{V}, I_D = 20\text{A}$	-	22	33	nC
$Q_{gs}$	Gate Source Charge		-	4.2	-	nC
$Q_{gd}$	Gate Drain("Miller") Charge		-	5.0	-	nC
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On DelayTime	$V_{GS} = 10\text{V}, V_{DD} = 15\text{V}$ $I_D = 20\text{A}, R_{GEN} = 3\Omega$	-	6.3	-	ns
$t_r$	Turn-On Rise Time		-	15	-	ns
$t_{d(off)}$	Turn-Off DelayTime		-	22	-	ns
$t_f$	Turn-Off Fall Time		-	6.1	-	ns
<b>Body Diode Characteristics</b>						
$I_S$	Maximum Continuous Body Diode Forward Current		-	-	57	A
$I_{SM}$	Maximum Pulsed Body Diode Forward Current		-	-	229	A
$V_{SD}$	Body Diode Forward Voltage	$V_{GS} = 0\text{V}, I_S = 20\text{A}$	-		1.2	V
$t_{rr}$	Body Diode Reverse Recovery Time	$I_F = 20\text{A}, di/dt = 100\text{A}/\mu\text{s}$	-	9.1	-	ns
$Q_{rr}$	Body Diode Reverse Recovery Charge		-	2.4	-	nC

- Notes:
1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature.
  2.  $E_{AS}$  condition: Starting  $T_J = 25^\circ\text{C}$ ,  $V_{DD} = 15\text{V}$ ,  $V_{GS} = 10\text{V}$ ,  $R_G = 25\text{ohm}$ ,  $L = 0.5\text{mH}$ ,  $I_{AS} = 11.9\text{A}$ ,  $V_{DD} = 0\text{V}$  during time in avalanche.
  3.  $R_{\theta JA}$  is measured with the device mounted on a 1inch<sup>2</sup> pad of 2oz copper FR4 PCB.
  4. Pulse Test: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 0.5\%$ .

**Electrical Characteristics-P** ( $T_J = 25^\circ\text{C}$  unless otherwise specified)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
<b>Off Characteristics</b>						
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$I_D = -250\mu\text{A}$ , $V_{GS} = 0\text{V}$	-30	-	-	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -30\text{V}$ , $V_{GS} = 0\text{V}$	-	-	-1.0	$\mu\text{A}$
$I_{GSS}$	Gate-Body Leakage Current	$V_{DS} = 0\text{V}$ , $V_{GS} = \pm 20\text{V}$	-	-	$\pm 100$	nA
<b>On Characteristics</b>						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ , $I_D = -250\mu\text{A}$	1.1	1.6	2.1	V
$R_{DS(ON)}$	Static Drain-Source ON-Resistance <sup>(5)</sup>	$V_{GS} = -10\text{V}$ , $I_D = -10\text{A}$	-	11.6	15.1	m $\Omega$
		$V_{GS} = -4.5\text{V}$ , $I_D = -5\text{A}$	-	15.7	20.4	m $\Omega$
<b>Dynamic Characteristics</b>						
$R_g$	Gate Resistance	$f = 1\text{MHz}$	-	7.6	-	$\Omega$
$C_{iss}$	Input Capacitance	$V_{GS} = 0\text{V}$ , $V_{DS} = -15\text{V}$ , $f = 1\text{MHz}$	-	2471	3706	pF
$C_{oss}$	Output Capacitance		-	232	464	pF
$C_{riss}$	Reverse Transfer Capacitance		-	200	401	pF
$Q_g$	Total Gate Charge	$V_{GS} = 0$ to $-10\text{V}$ $V_{DS} = -15\text{V}$ , $I_D = -10\text{A}$	-	45	67	nC
$Q_{gs}$	Gate Source Charge		-	7.6	-	nC
$Q_{gd}$	Gate Drain("Miller") Charge		-	7.4	-	nC
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On DelayTime	$V_{GS} = -10\text{V}$ , $V_{DD} = -15\text{V}$ $I_D = -10\text{A}$ , $R_{GEN} = 3\Omega$	-	7.2	-	ns
$t_r$	Turn-On Rise Time		-	1.6	-	ns
$t_{d(off)}$	Turn-Off DelayTime		-	77	-	ns
$t_f$	Turn-Off Fall Time		-	44	-	ns
<b>Body Diode Characteristics</b>						
$I_S$	Maximum Continuous Body Diode Forward Current		-	-	-44	A
$I_{SM}$	Maximum Pulsed Body Diode Forward Current		-	-	-177	A
$V_{SD}$	Body Diode Forward Voltage	$V_{GS} = 0\text{V}$ , $I_S = -10\text{A}$	-		-1.2	V
$t_{rr}$	Body Diode Reverse Recovery Time	$I_F = -10\text{A}$ , $di/dt = -100\text{A}/\mu\text{s}$	-	14	-	ns
$Q_{rr}$	Body Diode Reverse Recovery Charge		-	5.5	-	nC

Notes:

1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature.
2.  $E_{AS}$  condition: Starting  $T_J = 25^\circ\text{C}$ ,  $V_{DD} = -15\text{V}$ ,  $V_{GS} = -10\text{V}$ ,  $R_G = 25\text{ohm}$ ,  $L = 0.5\text{mH}$ ,  $I_{AS} = -16.8\text{A}$ ,  $V_{DD} = 0\text{V}$  during time in avalanche.
3.  $R_{\theta JA}$  is measured with the device mounted on a minimum recommended pad of 2oz copper FR4 PCB.
4. Pulse Test: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 0.5\%$ .



## Typical Performance Characteristics-N

Figure 1: Power De-rating

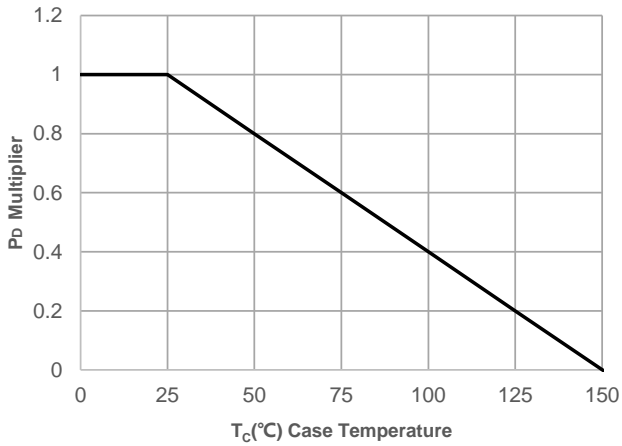


Figure 2: Current De-rating

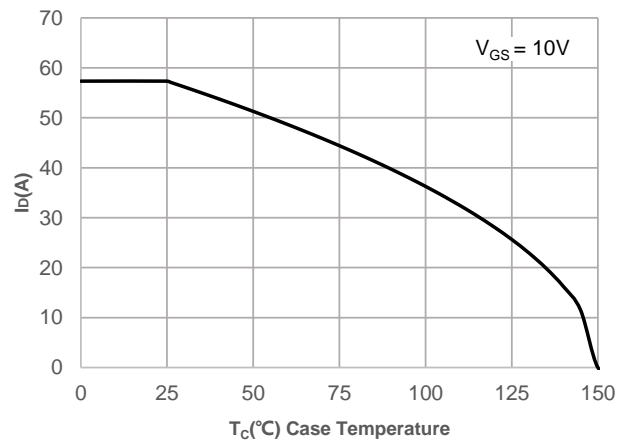


Figure 3: Normalized Maximum Transient Thermal Impedance

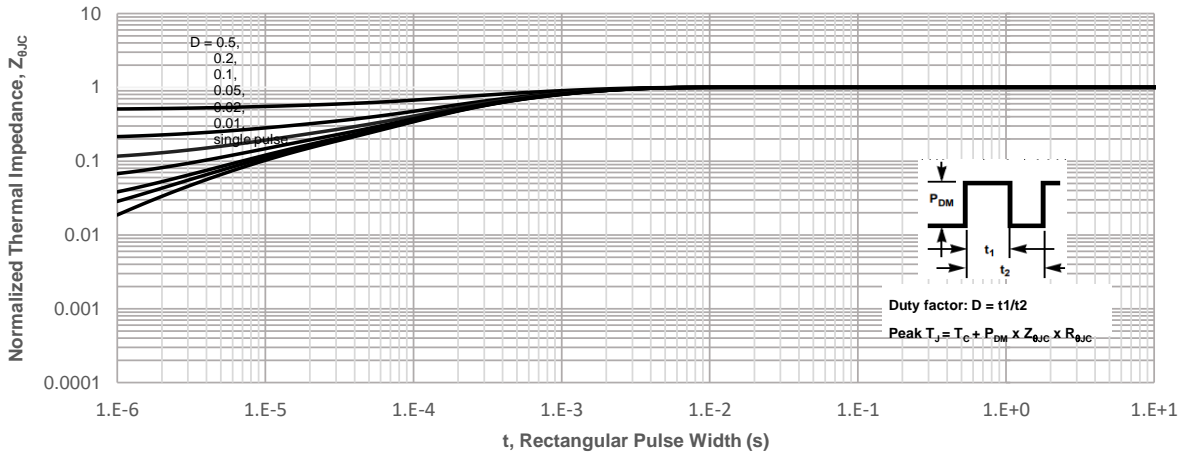
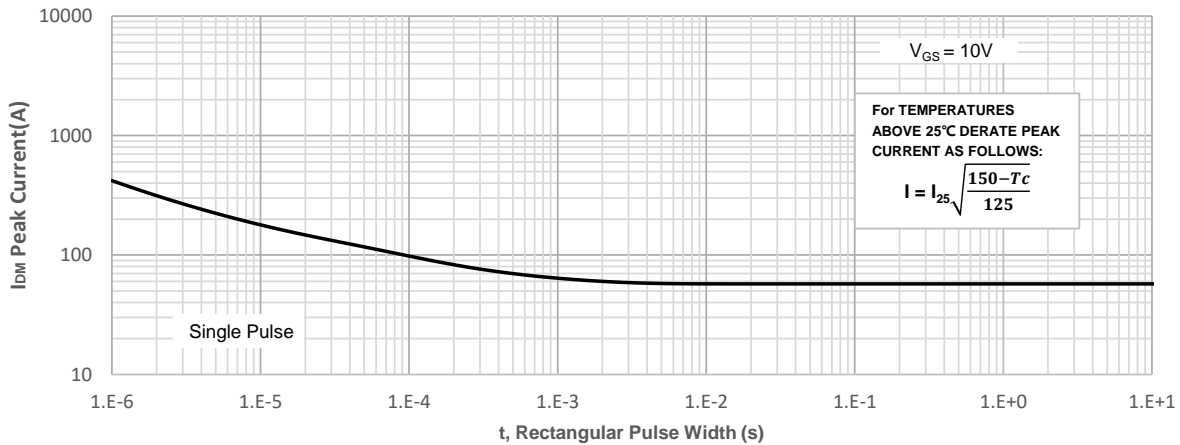


Figure 4: Peak Current Capacity



## Typical Performance Characteristics-N

Figure 5: Output Characteristics

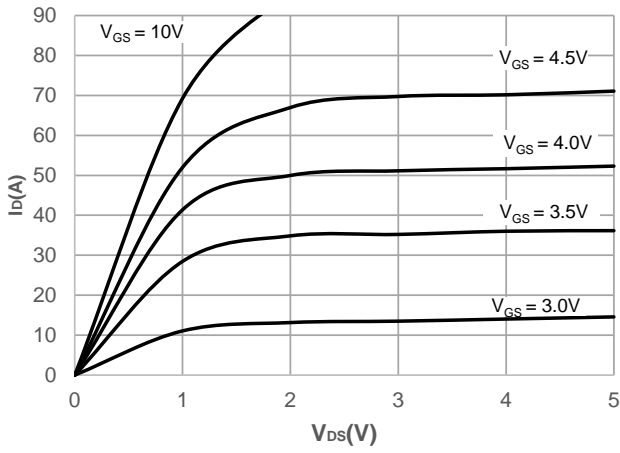


Figure 6: Typical Transfer Characteristics

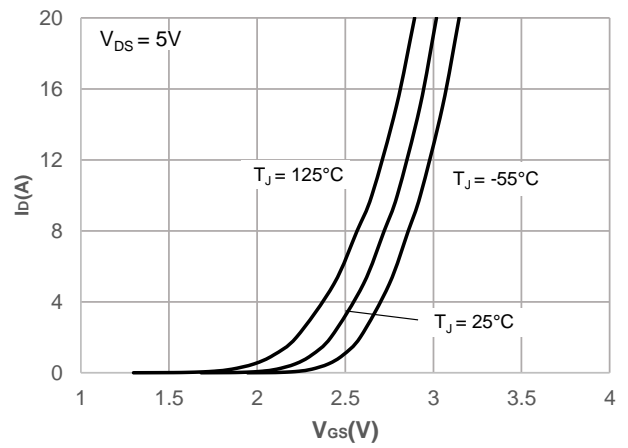


Figure 7: On-resistance vs. Drain Current

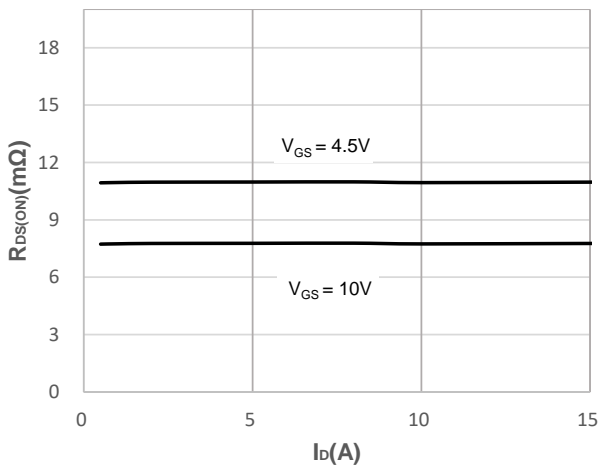


Figure 8: Body Diode Characteristics

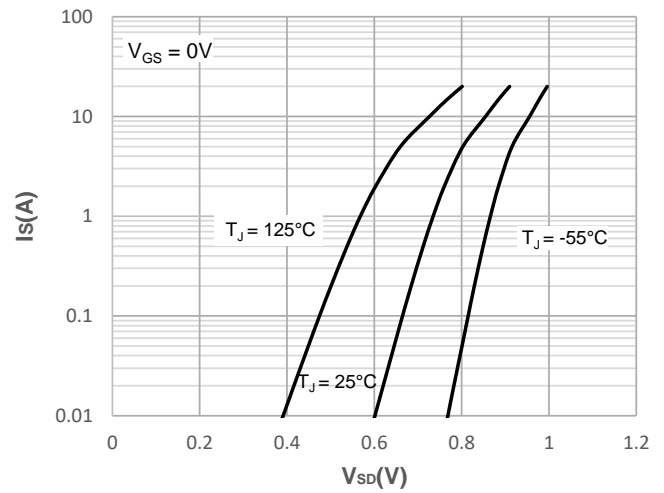


Figure 9: Gate Charge Characteristics

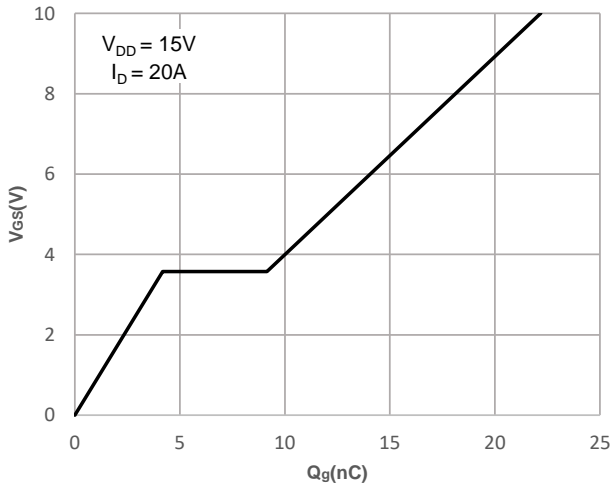
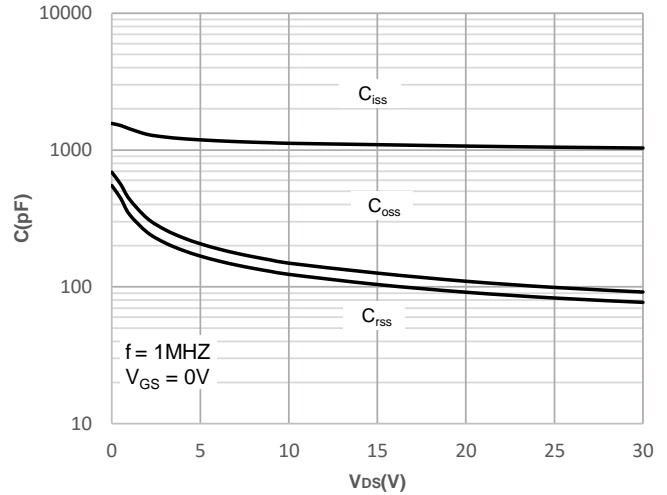


Figure 10: Capacitance Characteristics



## Typical Performance Characteristics-N

Figure 11: Normalized Breakdown voltage vs. Junction Temperature

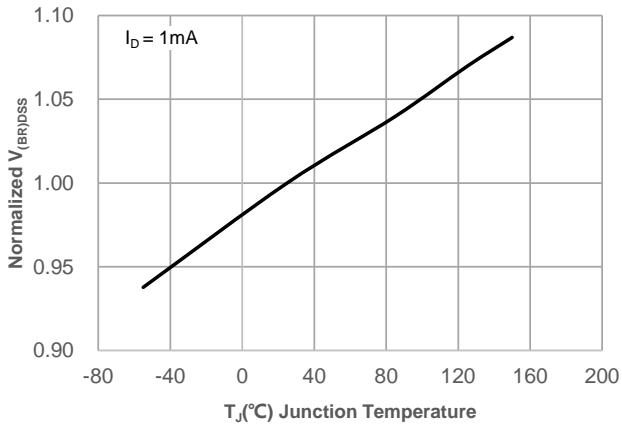


Figure 12: Normalized on Resistance vs. Junction Temperature

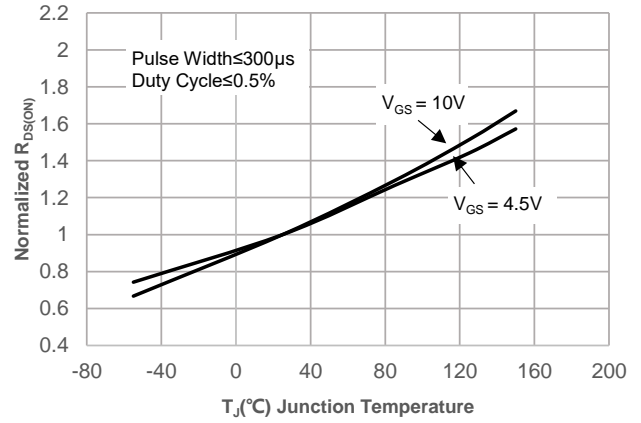


Figure 13: Normalized Threshold Voltage vs. Junction Temperature

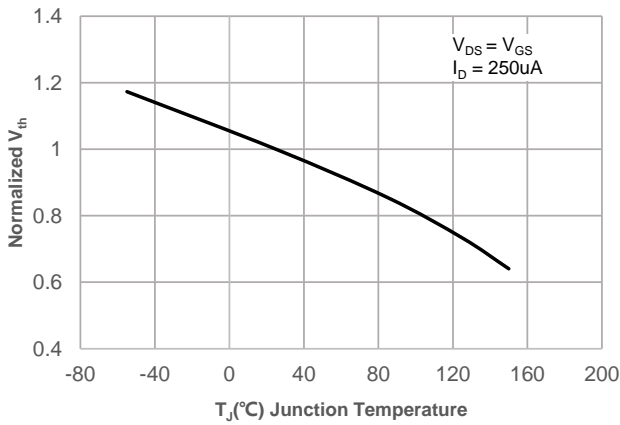


Figure 14:  $R_{DS(ON)}$  vs.  $V_{GS}$

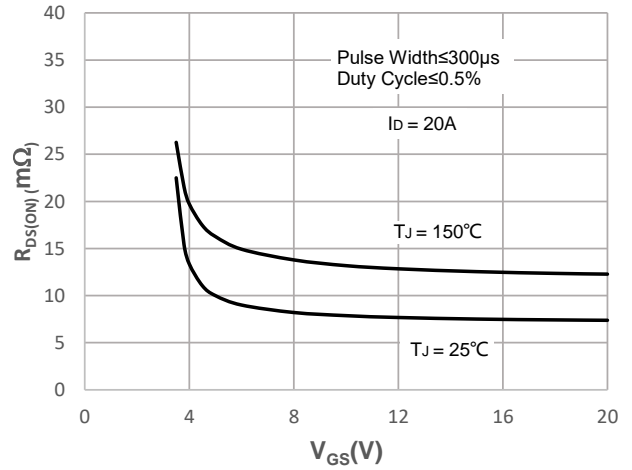
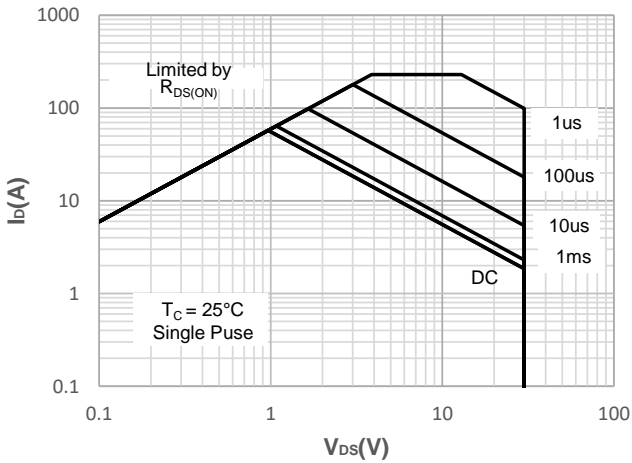


Figure 15: Maximum Safe Operating Area



## Typical Performance Characteristics-P

Figure 1: Power De-rating

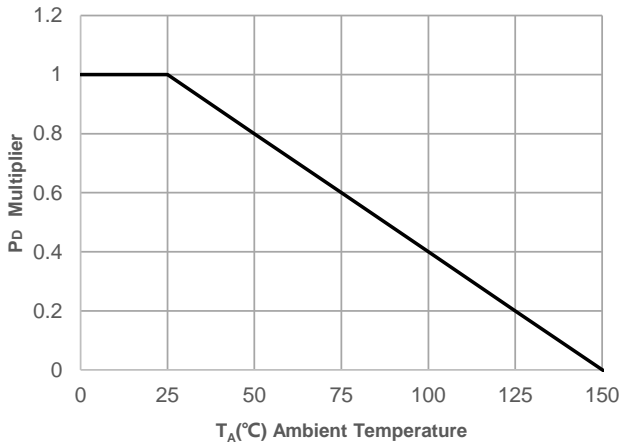


Figure 2: Current De-rating

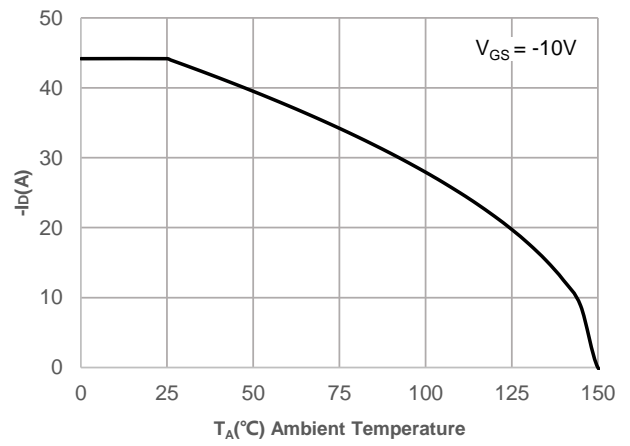


Figure 3: Normalized Maximum Transient Thermal Impedance

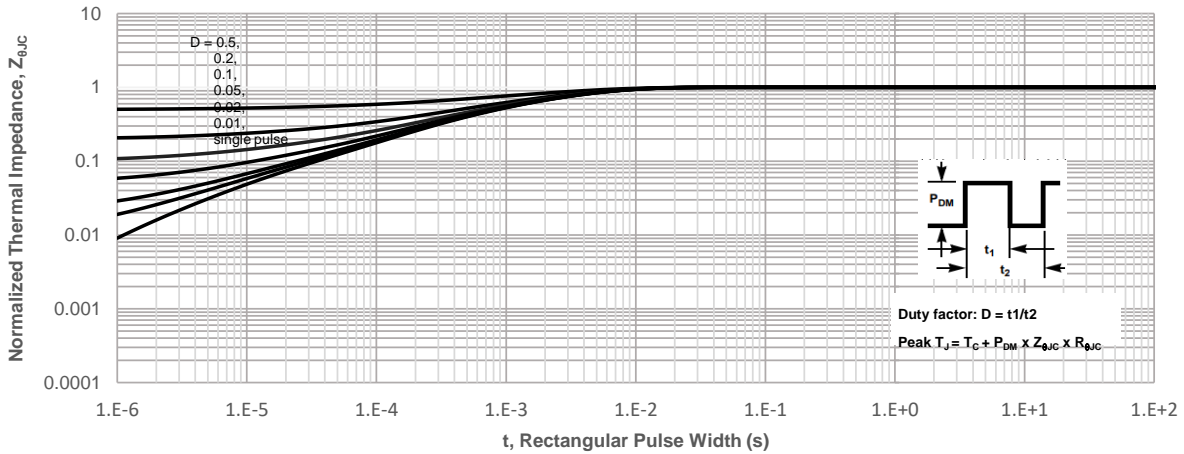
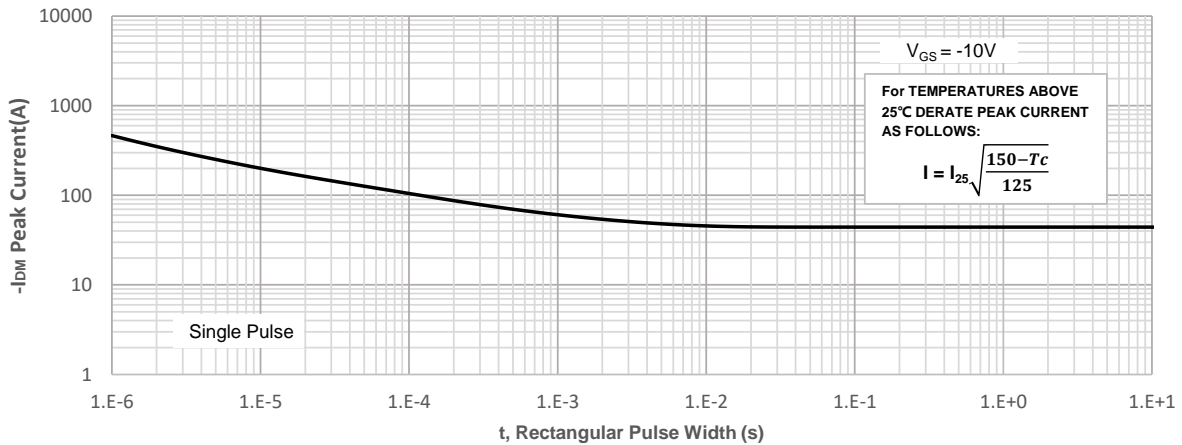


Figure 4: Peak Current Capacity



## Typical Performance Characteristics-P

Figure 5: Output Characteristics

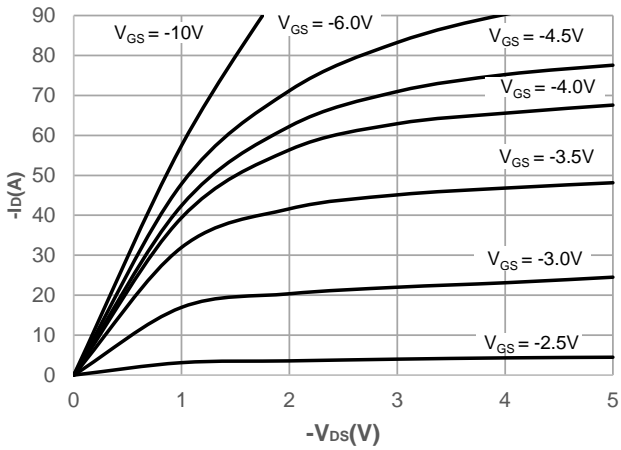


Figure 6: Typical Transfer Characteristics

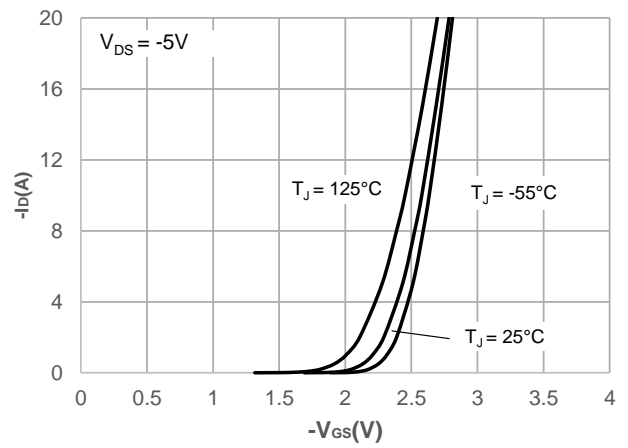


Figure 7: On-resistance vs. Drain Current

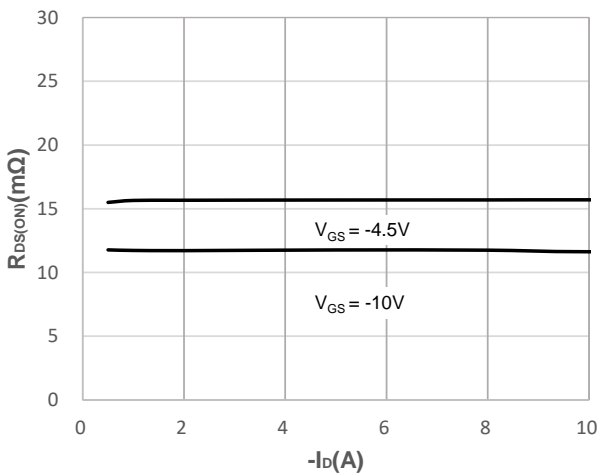


Figure 8: Body Diode Characteristics

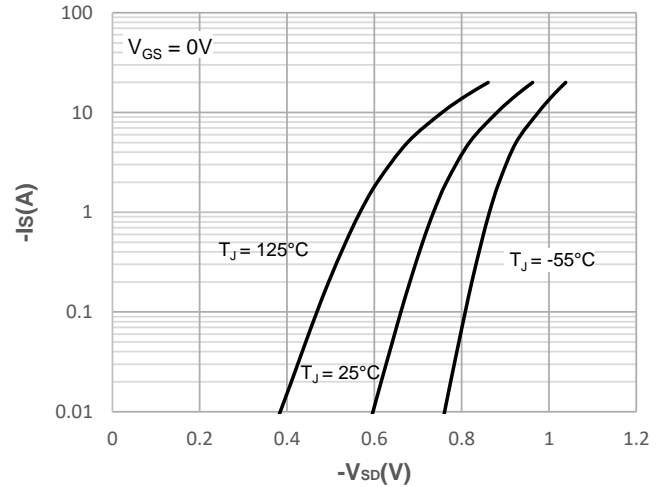


Figure 9: Gate Charge Characteristics

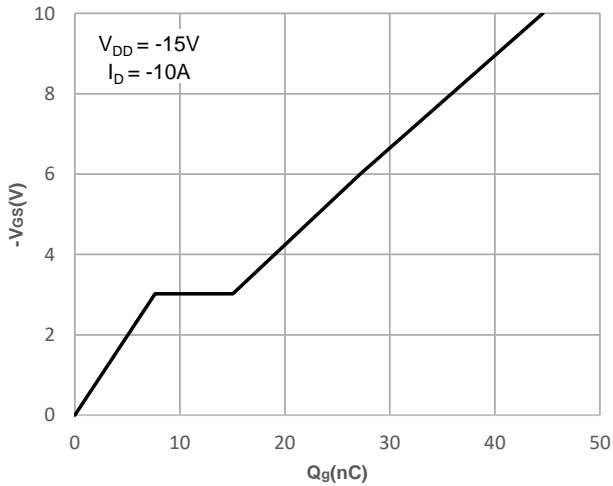
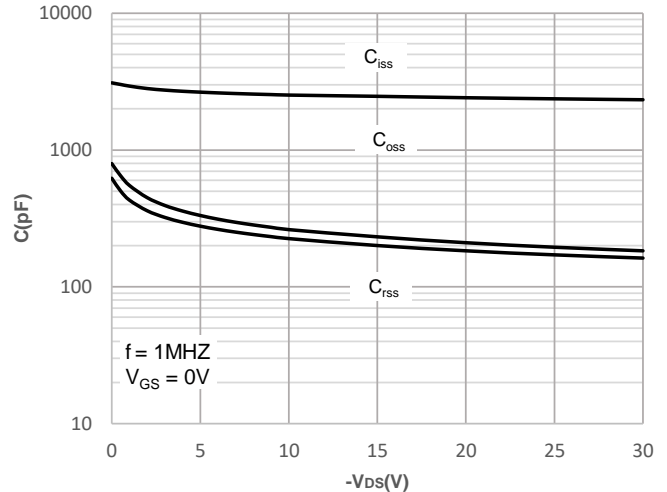


Figure 10: Capacitance Characteristics



## Typical Performance Characteristics-P

Figure 11: Normalized Breakdown voltage vs. Junction Temperature

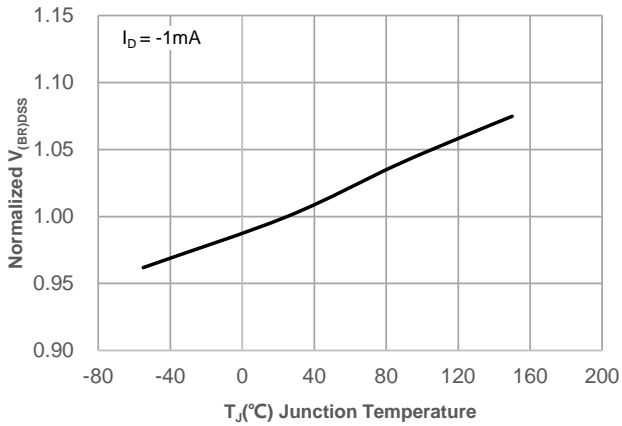


Figure 12: Normalized on Resistance vs. Junction Temperature

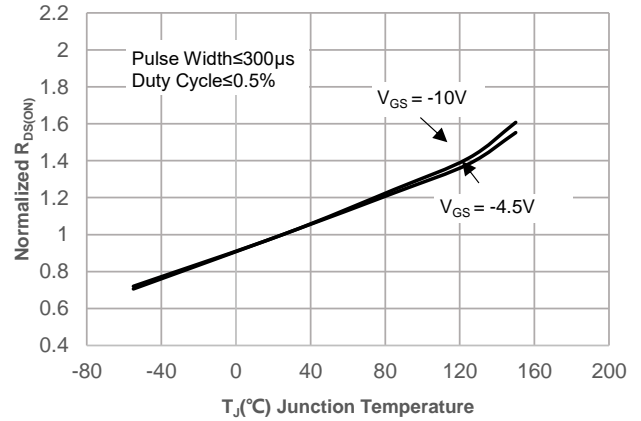


Figure 13: Normalized Threshold Voltage vs. Junction Temperature

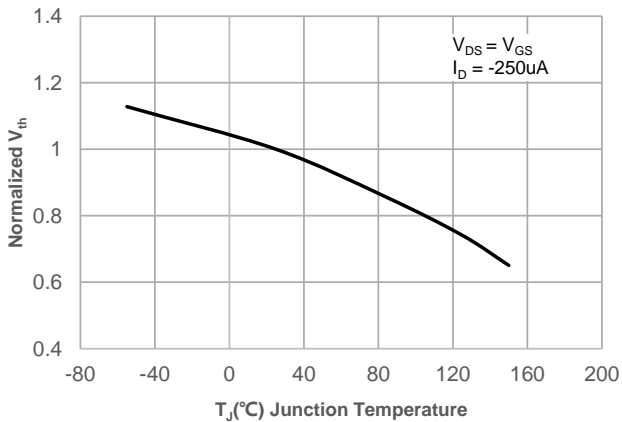


Figure 14:  $R_{DS(ON)}$  vs.  $V_{GS}$

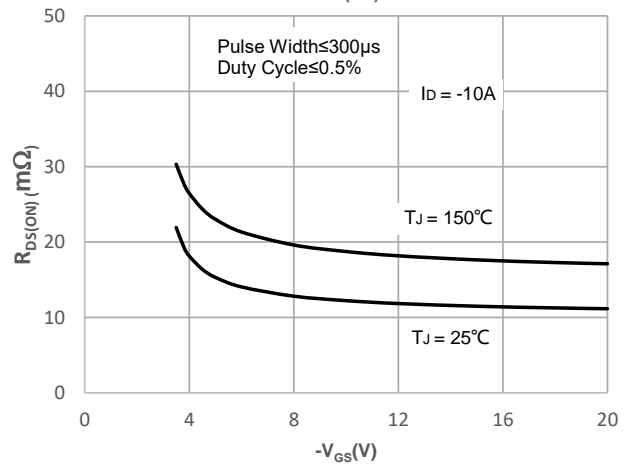
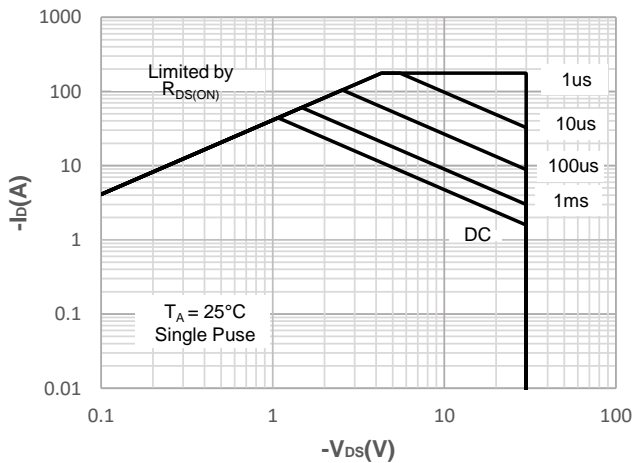


Figure 15: Maximum Safe Operating Area



### Test Circuit

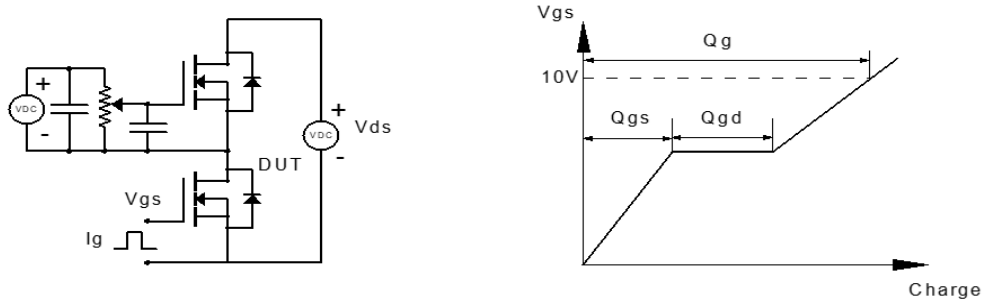


Figure 1: Gate Charge Test Circuit & Waveform

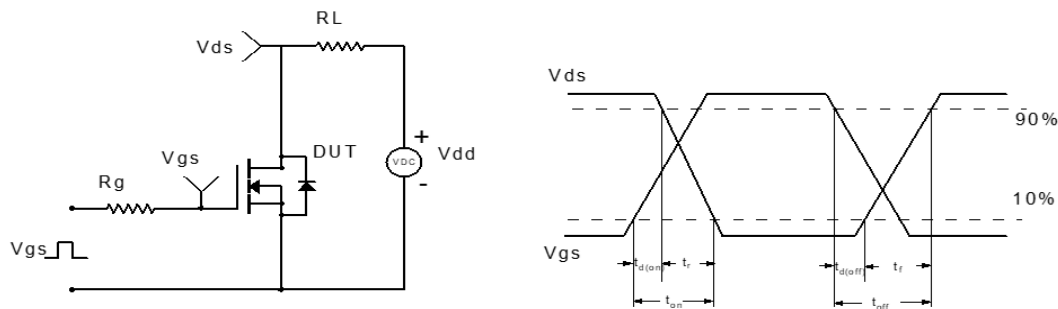


Figure 2: Resistive Switching Test Circuit & Waveform

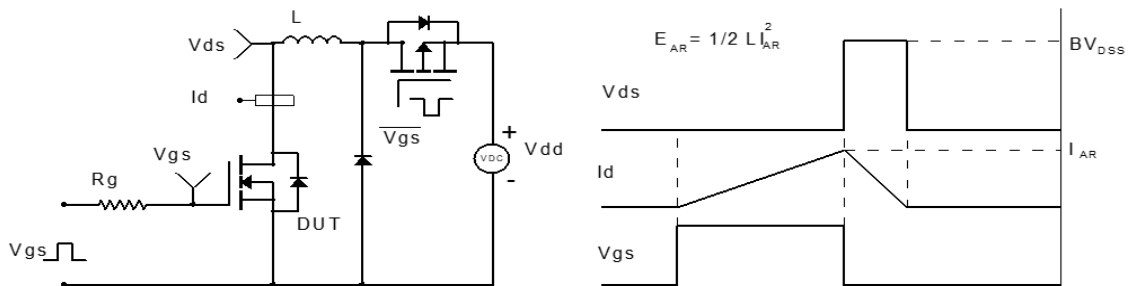


Figure 3: Unclamped Inductive Switching Test Circuit & Waveform

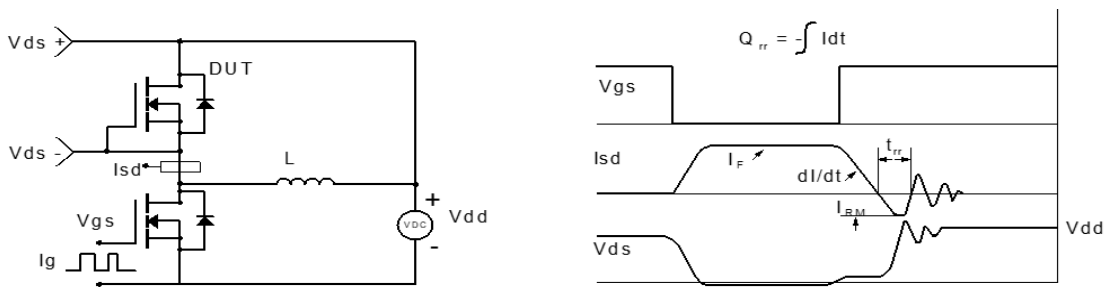


Figure 4: Diode Recovery Test Circuit & Waveform

### Test Circuit

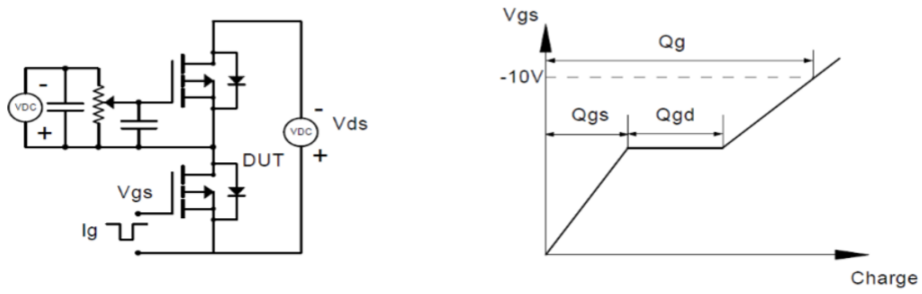


Figure 1: Gate Charge Test Circuit & Waveform

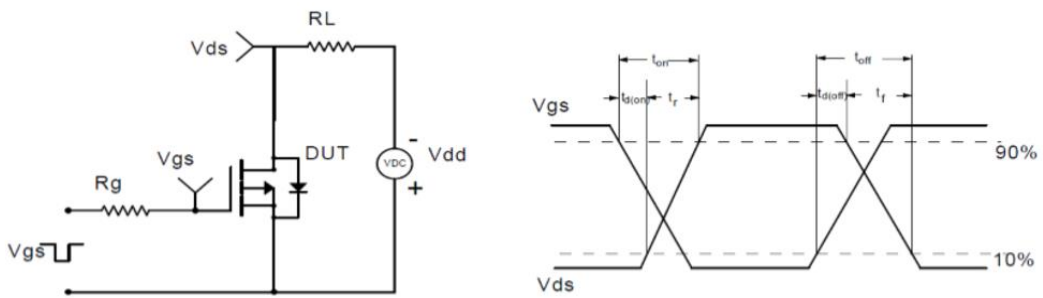


Figure 2: Resistive Switching Test Circuit & Waveform

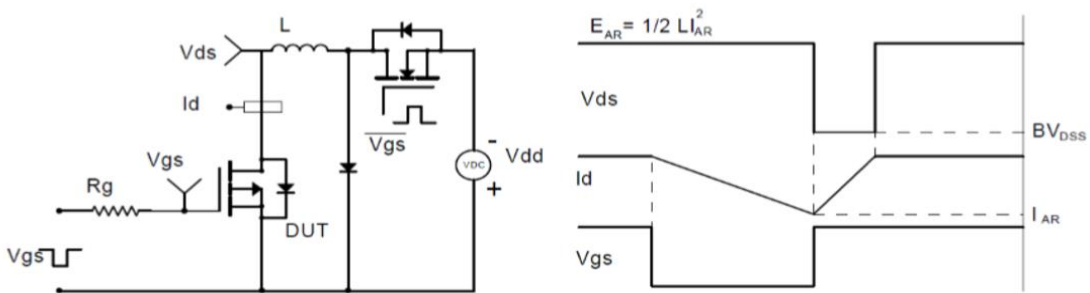


Figure 3: Unclamped Inductive Switching Test Circuit & Waveform

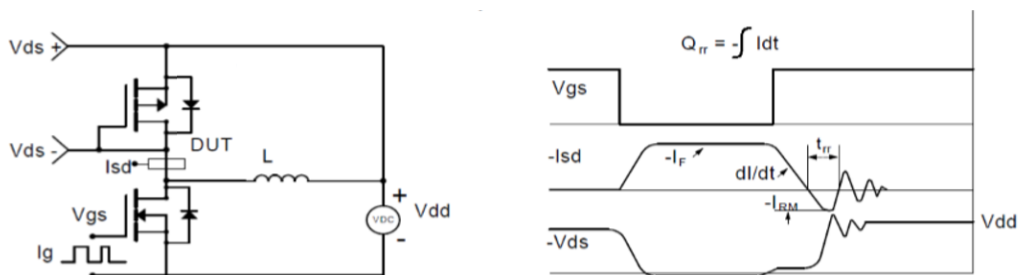
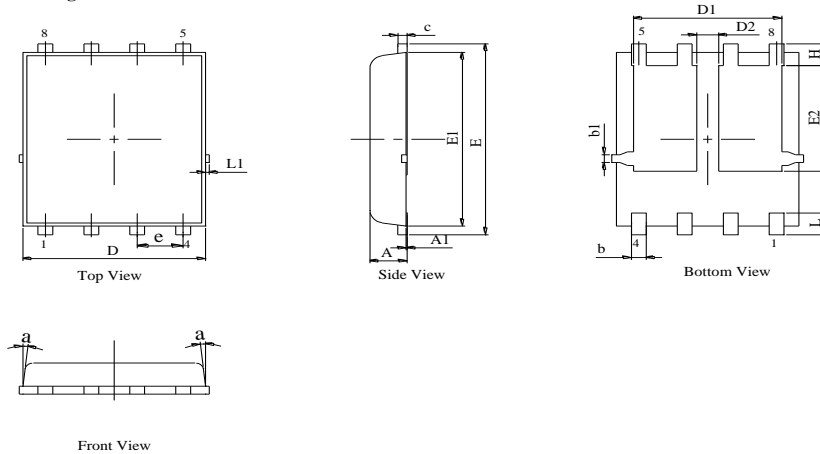


Figure 4: Diode Recovery Test Circuit & Waveform



## Package Mechanical Data(PDFN5x6-8L-D)

### Package Outline

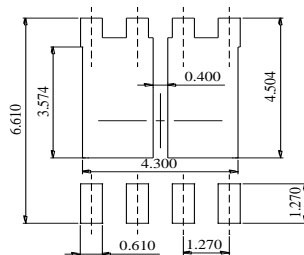


### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M,1994.
2. ALL DIMENSIONS IN MILLIMETER (ANGLE IN DEGREE).
3. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.

DIM.	MILLIMETER		
	MIN.	NOM.	MAX.
A	0.90	1.00	1.10
A1	0.00	-	0.10
b	0.31	0.41	0.51
b1	0.15	0.25	0.35
c	0.23	-	0.33
D	4.95	5.05	5.15
D1	4.00	4.10	4.20
D2	0.50	0.60	0.70
E	6.05	6.15	6.25
E1	5.50	5.60	5.70
E2	3.31	3.41	3.51
e	-	1.27BSC	-
H	0.60	0.70	0.80
L	0.50	0.70	0.80
L1	-	-	0.125
a	-	-	12°

### Recommended Soldering Footprint



DIMENSIONS: MILLIMETERS

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