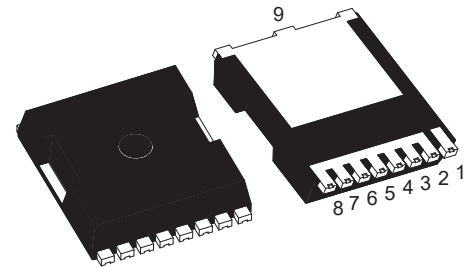
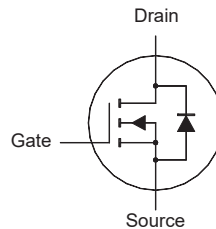


N-Channel Enhancement Mode MOSFET

Features

- Low $R_{DS(ON)}$
- Surface-mounted package
- Halogen and Antimony Free(HAF), RoHS compliant



1.Gate 2~8.Source 9.Drain
TOLL Plastic Package

Key Parameters

Parameter	Value	Unit
BV_{DSS}	120	V
$R_{DS(ON)} \text{ Max}$	2.4 @ $V_{GS} = 10 \text{ V}$	m Ω
$V_{GS(th)} \text{ typ}$	3.4	V
$Q_g \text{ typ}$	143 @ $V_{GS} = 10 \text{ V}$	nC

Absolute Maximum Ratings(at $T_a = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DS}	120	V
Gate-Source Voltage	V_{GS}	± 20	V
Drain Current	I_D	186 117	A
Peak Drain Current, Pulsed ¹⁾	I_{DM}	740	A
Avalanche Current	I_{AS}	68.6	A
Single Pulse Avalanche Energy ²⁾	E_{AS}	1176.5	mJ
Total Power Dissipation	P_{tot}	166.6	W
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to + 150	$^\circ\text{C}$

Thermal Characteristics

Parameter	Symbol	Max.	Unit
Thermal Resistance from Junction to Case	$R_{\theta JC}$	0.75	$^\circ\text{C/W}$
Thermal Resistance from Junction to Ambient ³⁾	$R_{\theta JA}$	35	$^\circ\text{C/W}$

¹⁾ Pulse Test: Pulse Width $\leq 100 \mu\text{s}$, Duty Cycle $\leq 2\%$, Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)} = 150^\circ\text{C}$.

²⁾ Limited by $T_{J(MAX)}$, starting $T_J = 25^\circ\text{C}$, $L = 0.5 \text{ mH}$, $R_g = 25 \Omega$, $I_{AS} = 68.6 \text{ A}$, $V_{GS} = 10 \text{ V}$.

³⁾ Device mounted on FR-4 substrate PC board, 2oz copper, with 1-inch square copper plate in still air.

Characteristics at $T_a = 25^\circ\text{C}$ unless otherwise specified

Parameter	Symbol	Min.	Typ.	Max.	Unit
STATIC PARAMETERS					
Drain-Source Breakdown Voltage at $I_D = 5\text{ mA}$	BV_{DSS}	120	-	-	V
Drain-Source Leakage Current at $V_{DS} = 120\text{ V}$	I_{DSS}	-	-	1	μA
Gate Leakage Current at $V_{GS} = \pm 20\text{ V}$	I_{GSS}	-	-	± 100	nA
Gate-Source Threshold Voltage at $V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	$V_{GS(th)}$	2.6	-	4	V
Drain-Source On-State Resistance at $V_{GS} = 10\text{ V}$, $I_D = 50\text{ A}$	$R_{DS(on)}$	-	2	2.4	$\text{m}\Omega$
DYNAMIC PARAMETERS					
Forward Transconductance at $V_{DS} = 5\text{ V}$, $I_D = 20\text{ A}$	g_{fs}	-	63	-	S
Gate Resistance at $V_{GS} = 0\text{ V}$, $V_{DS} = 0\text{ V}$, $f = 1\text{ MHz}$	R_g	-	1.1	-	Ω
Input Capacitance at $V_{GS} = 0\text{ V}$, $V_{DS} = 60\text{ V}$, $f = 1\text{ MHz}$	C_{iss}	-	10732	-	pF
Output Capacitance at $V_{GS} = 0\text{ V}$, $V_{DS} = 60\text{ V}$, $f = 1\text{ MHz}$	C_{oss}	-	1245	-	pF
Reverse Transfer Capacitance at $V_{GS} = 0\text{ V}$, $V_{DS} = 60\text{ V}$, $f = 1\text{ MHz}$	C_{rss}	-	34	-	pF
Gate charge total at $V_{DS} = 60\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 50\text{ A}$	Q_g	-	143	-	nC
Gate to Source Charge at $V_{DS} = 60\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 50\text{ A}$	Q_{gs}	-	61	-	nC
Gate to Drain Charge at $V_{DS} = 60\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 50\text{ A}$	Q_{gd}	-	21	-	nC
Turn-On Delay Time at $V_{DS} = 60\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 50\text{ A}$, $R_g = 3.3\text{ }\Omega$	$t_{d(on)}$	-	70	-	ns
Turn-On Rise Time at $V_{DS} = 60\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 50\text{ A}$, $R_g = 3.3\text{ }\Omega$	t_r	-	58	-	ns
Turn-Off Delay Time at $V_{DS} = 60\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 50\text{ A}$, $R_g = 3.3\text{ }\Omega$	$t_{d(off)}$	-	33	-	ns
Turn-Off Fall Time at $V_{DS} = 60\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 50\text{ A}$, $R_g = 3.3\text{ }\Omega$	t_f	-	8	-	ns
Body-Diode PARAMETERS					
Drain-Source Diode Forward Voltage at $I_S = 1\text{ A}$, $V_{GS} = 0\text{ V}$	V_{SD}	-	-	1.2	V
Body-Diode Continuous Current	I_S	-	-	186	A
Body-Diode Continuous Current, Pulsed	I_{SM}	-	-	740	A
Body Diode Reverse Recovery Time at $I_S = 50\text{ A}$, $di/dt = 200\text{ A}/\mu\text{s}$	t_{rr}	-	90	-	ns
Body Diode Reverse Recovery Charge at $I_S = 50\text{ A}$, $di/dt = 200\text{ A}/\mu\text{s}$	Q_{rr}	-	531	-	nC

Electrical Characteristics Curves

Fig. 1 Typical Output Characteristics

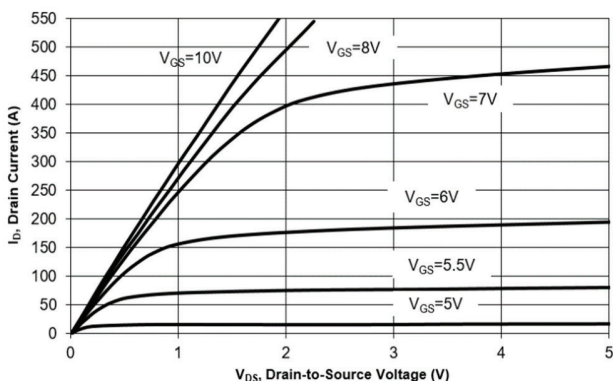


Fig. 2 Typical Transfer Characteristics

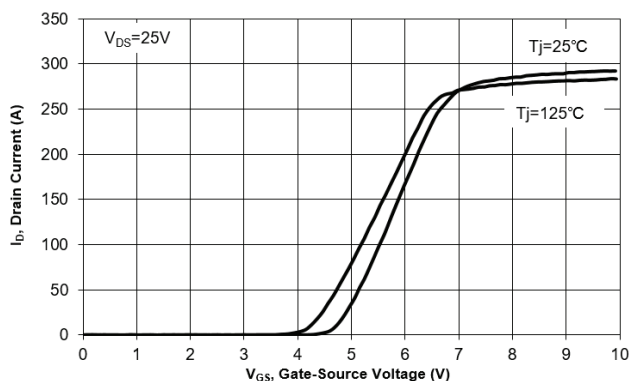


Fig. 3 On-Resistance vs. Drain Current

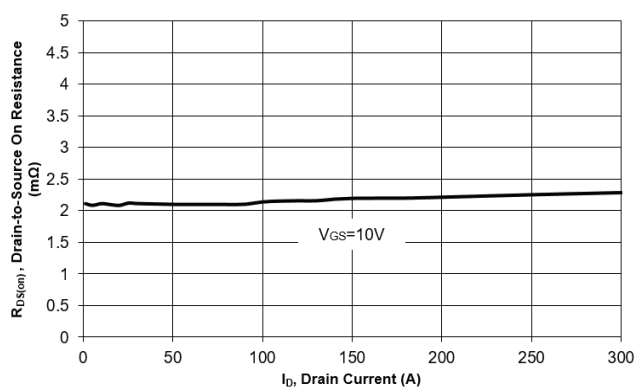


Fig. 4 On-Resistance vs. Gate to Source Voltage

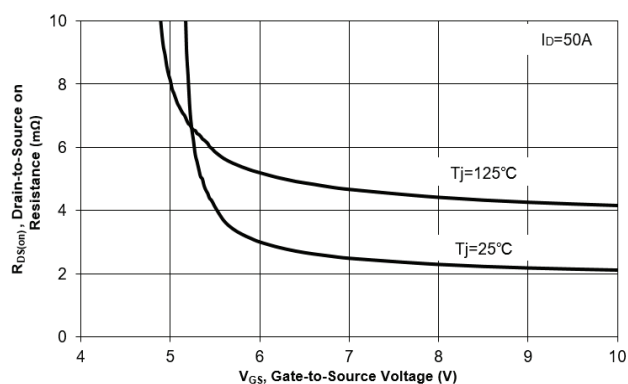


Fig. 5 On-Resistance vs. T_J

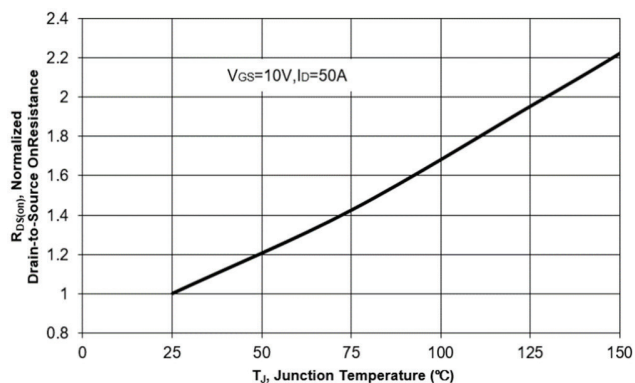
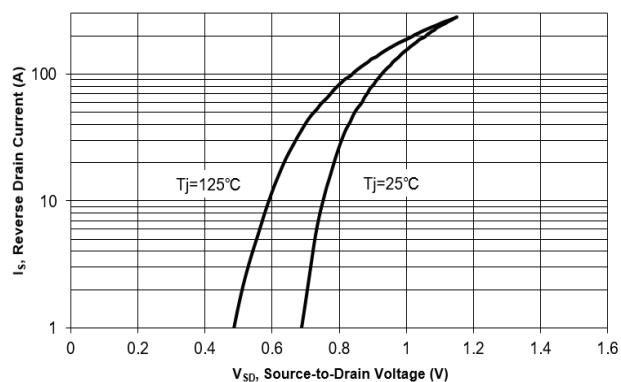


Fig. 6 Typical Body Diode Forward Characteristics



Electrical Characteristics Curves

Fig. 13 Normalized Maximum Transient Thermal Impedance($z_{\theta JC}$)

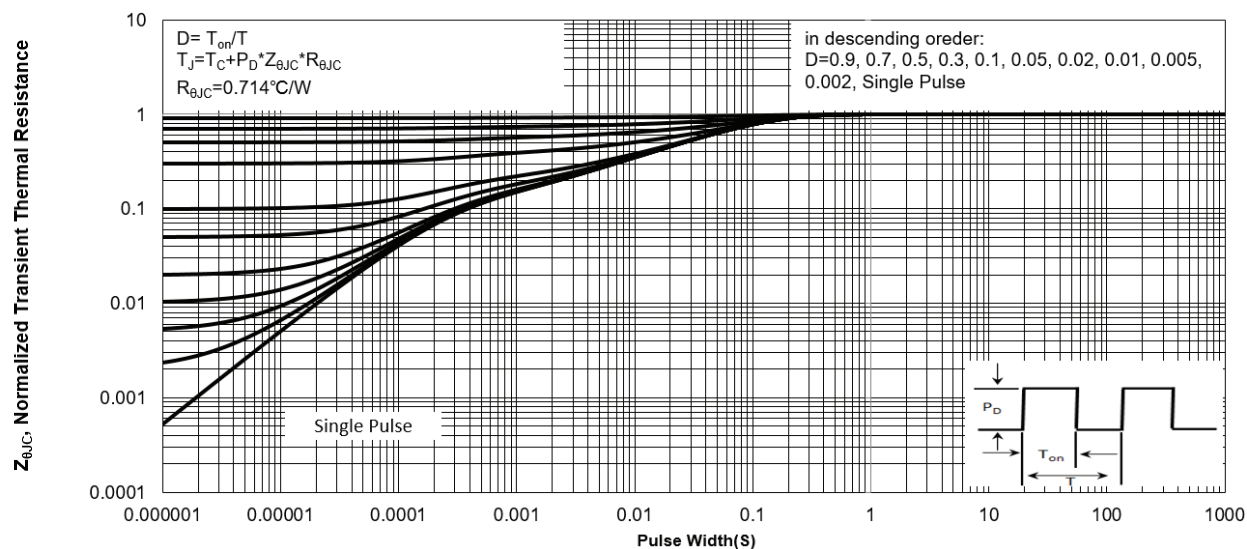


Fig. 14 Normalized Maximum Transient Thermal Impedance($z_{\theta JA}$)

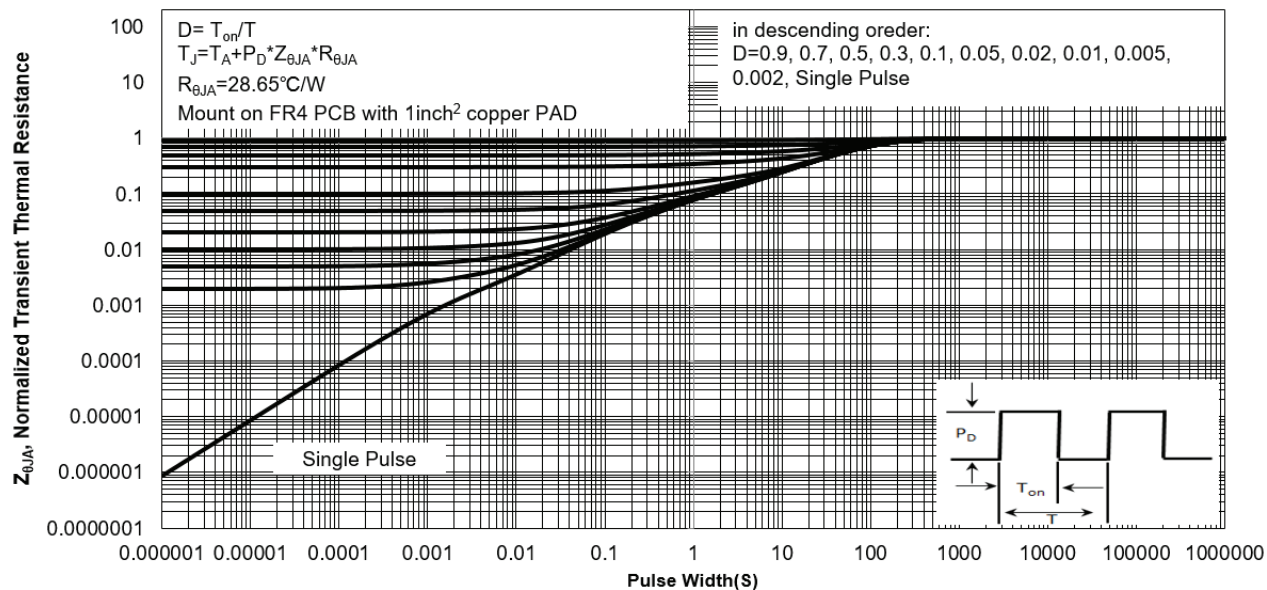


Fig. 7 Typical Junction Capacitance

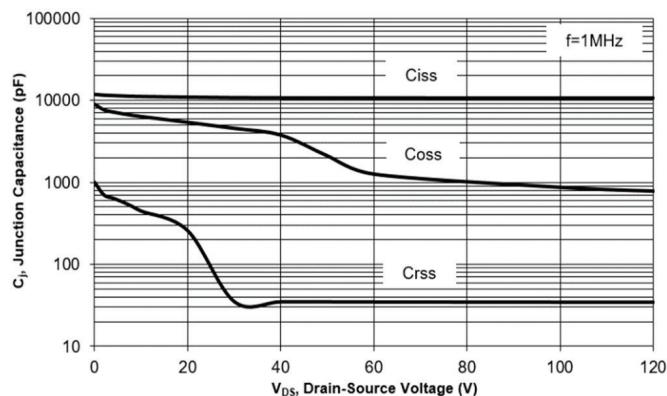


Fig. 8 Drain-Source Leakage Current vs. T_j

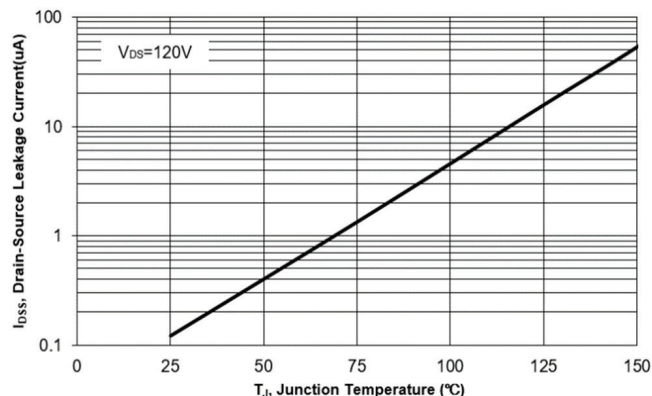


Fig. 9 $V_{(BR)DSS}$ vs. Junction Temperature

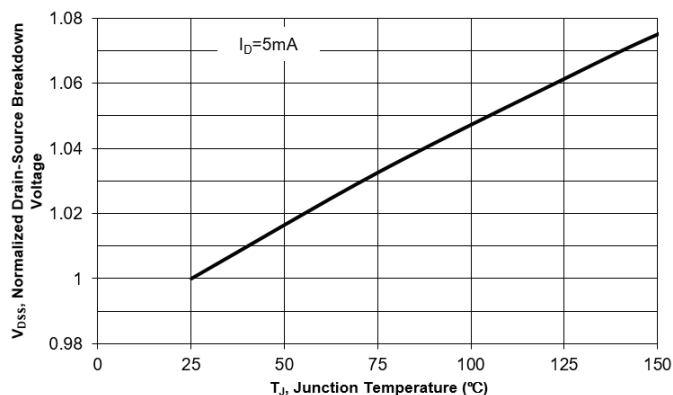


Fig. 10 Gate Threshold Variation vs. T_j

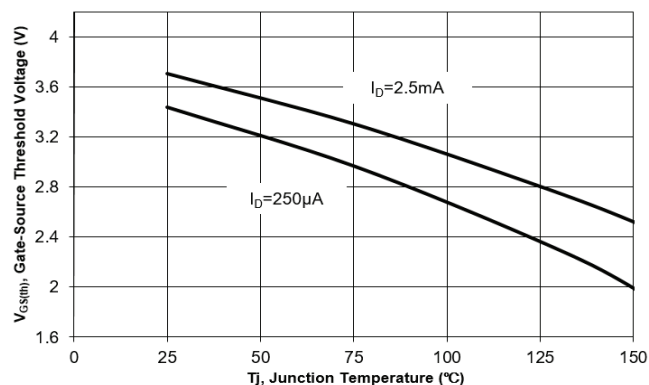


Fig. 11 Gate Charge

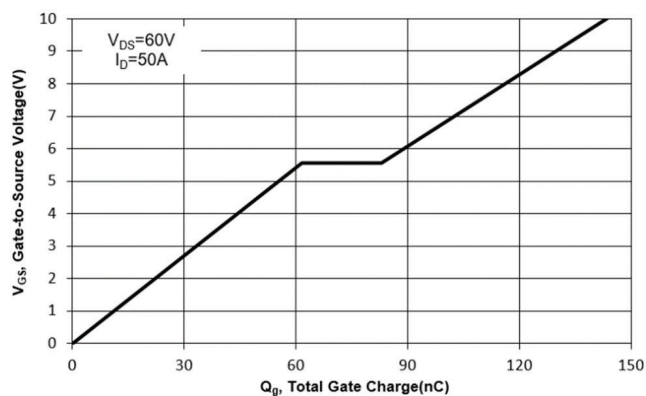
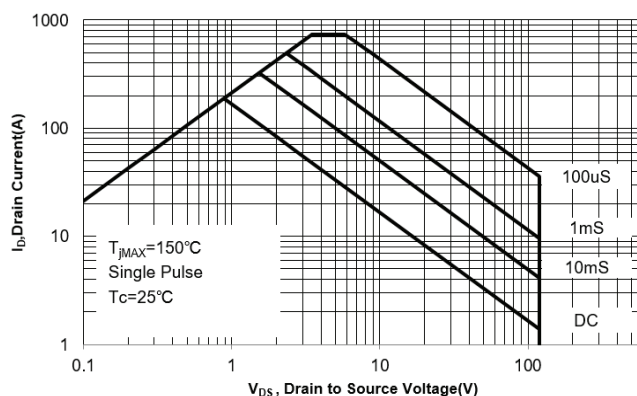
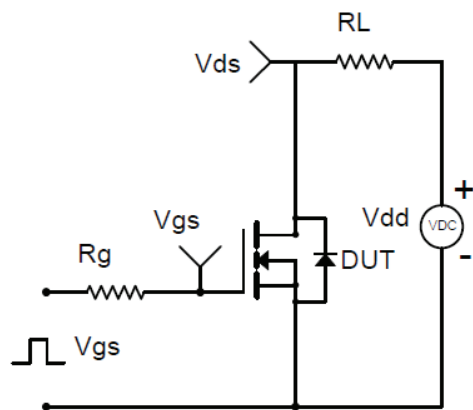
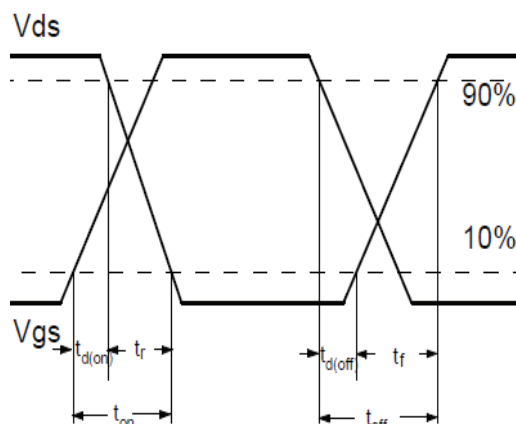
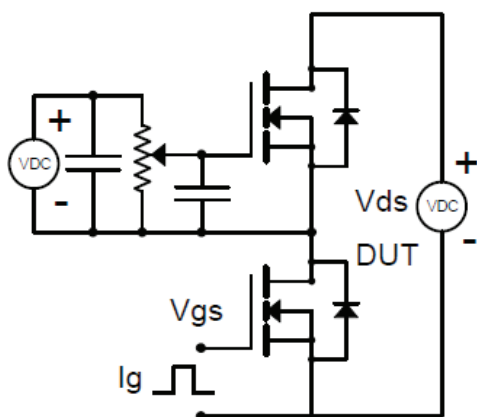
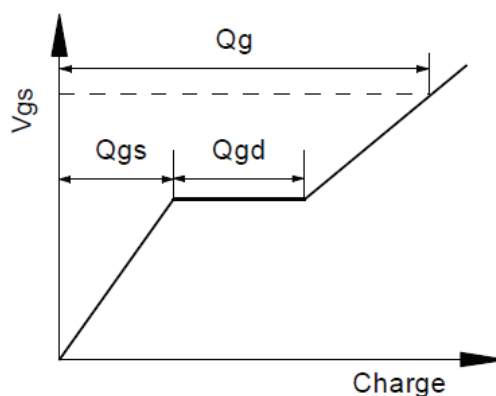
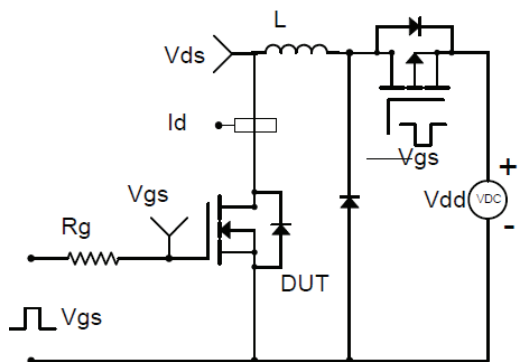
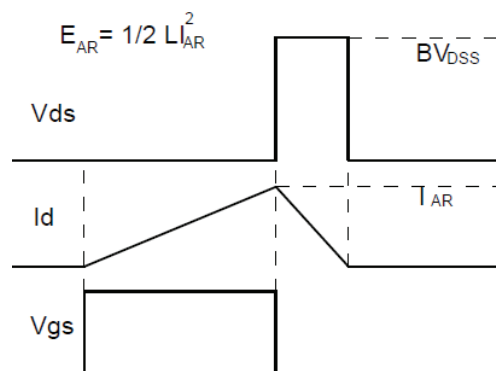
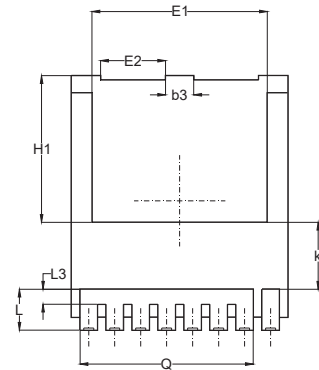
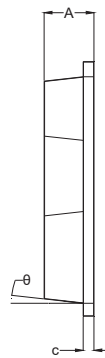
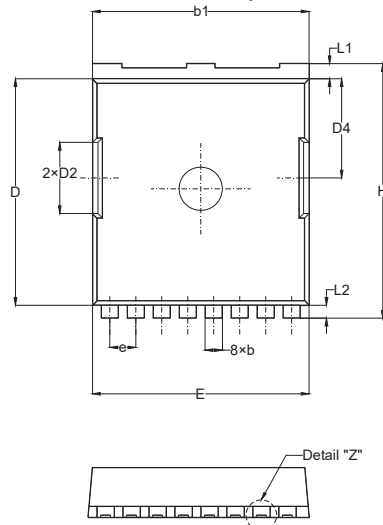


Fig. 12 Safe Operation Area



Test Circuits
Fig.1-1 Switching times test circuit

Fig.1-2 Switching Waveform

Fig.2-1 Gate charge test circuit

Fig.2-2 Gate charge waveform

Fig.3-1 Avalanche test circuit

Fig.3-2 Avalanche waveform


Package Outline Dimensions (Units: mm)

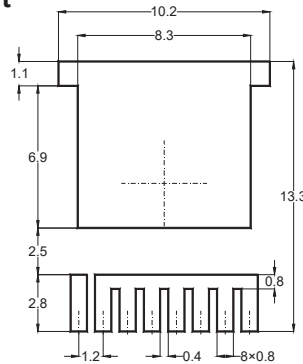


TOLL

SYMBOL	A	b	b1	b3	c	D	D2	D4	E	E1	e	H	H1	j
MIN	2.20	0.65	9.70	1.15	0.40	10.28	3.20	4.45	9.80	7.90	1.20	11.48	6.95	0.35
NOM	2.30	0.75	9.80	1.25	0.50	10.38	3.30	4.55	9.90	8.10	BSC	11.68	REF	REF
MAX	2.40	0.90	9.90	1.35	0.60	10.48	3.40	4.65	10.00	8.30		11.88		

SYMBOL	k	L	L1	L2	L3	N	Q	E2	Θ
MIN	3.0	1.35	0.50	0.50	0.25	8	8	2.8	10°
NOM	REF	1.55	0.70	0.60	0.45		REF	3.0	REF
MAX		1.75	0.90	0.70	0.65			3.2	

Recommended Soldering Footprint



Packing information

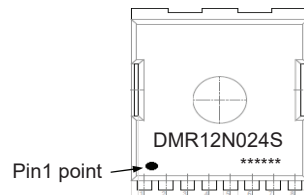
Package	Tape Width (mm)	Pitch		Reel Size		Per Reel Packing Quantity
		mm	inch	mm	inch	
TOLL	24	12 ± 0.1	0.472 ± 0.004	330	13	2,000

Marking information

" DMR12N024S " = Part No.

" ***** " = Date Code Marking

Font type: Arial



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