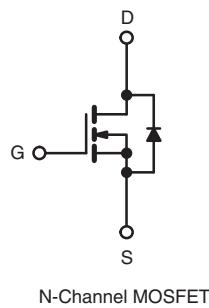


E Series Power MOSFET

PRODUCT SUMMARY	
V_{DS} (V) at T_J max.	650
$R_{DS(on)}$ max. at 25 °C (Ω)	$V_{GS} = 10$ V 0.28
Q_g max. (nC)	78
Q_{gs} (nC)	9
Q_{gd} (nC)	17
Configuration	Single

FEATURES

- Low Figure-of-Merit (FOM) $R_{on} \times Q_g$
- Low Input Capacitance (C_{iss})
- Reduced Switching and Conduction Losses
- Ultra Low Gate Charge (Q_g)
- Avalanche Energy Rated (UIS)
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912



APPLICATIONS

- Server and Telecom Power Supplies
- Switch Mode Power Supplies (SMPS)
- Power Factor Correction Power Supplies (PFC)
- Lighting
 - High-Intensity Discharge (HID)
 - Fluorescent Ballast Lighting
- Industrial
 - Welding
 - Induction Heating
 - Motor Drives
 - Battery Chargers
 - Renewable Energy
 - Solar (PV Inverters)

ORDERING INFORMATION	
Package	TO-220AB
Lead (Pb)-free	SiHP15N60E-E3
Lead (Pb)-free and Halogen-free	SiHP15N60E-GE3

ABSOLUTE MAXIMUM RATINGS ($T_C = 25$ °C, unless otherwise noted)				
PARAMETER		SYMBOL	LIMIT	UNIT
Drain-Source Voltage		V_{DS}	600	V
Gate-Source Voltage		V_{GS}	± 20	
Gate-Source Voltage AC ($f > 1$ Hz)			30	
Continuous Drain Current ($T_J = 150$ °C)	V_{GS} at 10 V	I_D	15	A
	$T_C = 25$ °C		9.6	
Pulsed Drain Current ^a		I_{DM}	39	W/°C
Linear Derating Factor			1.4	
Single Pulse Avalanche Energy ^b		E_{AS}	102	mJ
Maximum Power Dissipation		P_D	180	W
Operating Junction and Storage Temperature Range		T_J, T_{stg}	- 55 to + 150	°C
Drain-Source Voltage Slope	$T_J = 125$ °C	dV/dt	37	V/ns
Reverse Diode dV/dt ^d			7.7	
Soldering Recommendations (Peak Temperature) ^c	for 10 s		300	°C

Notes

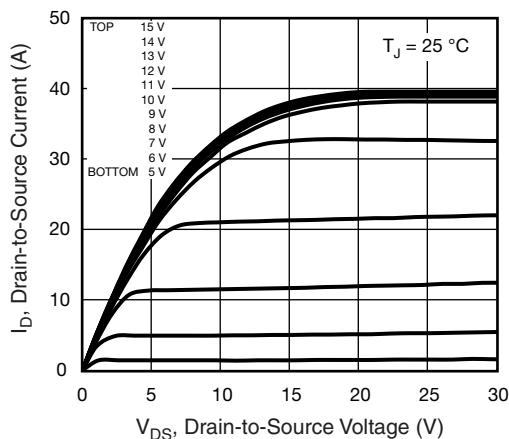
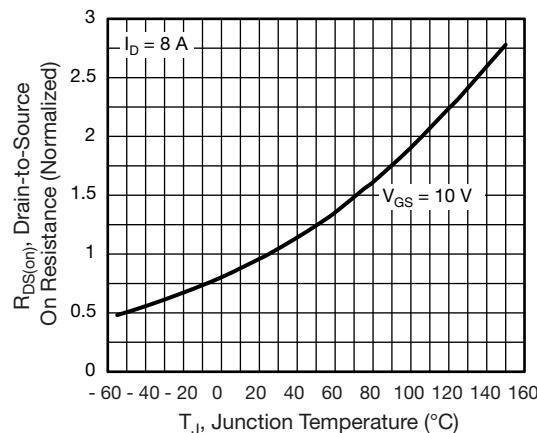
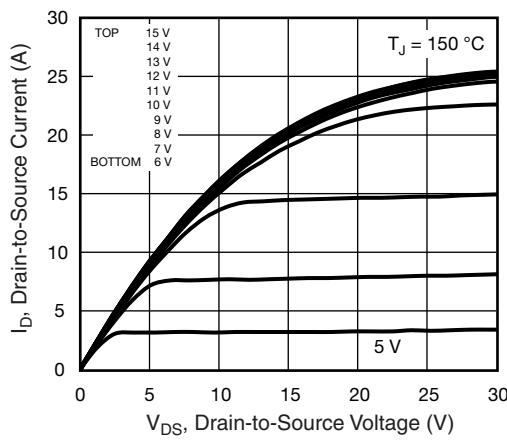
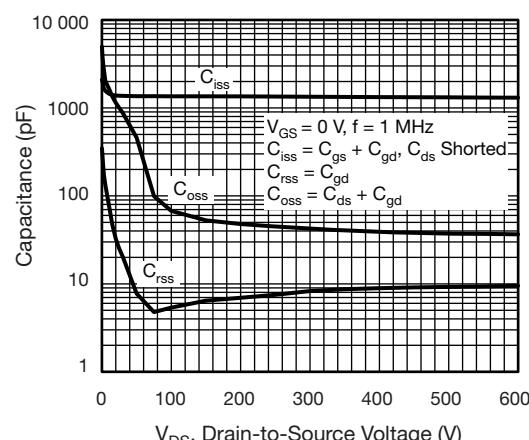
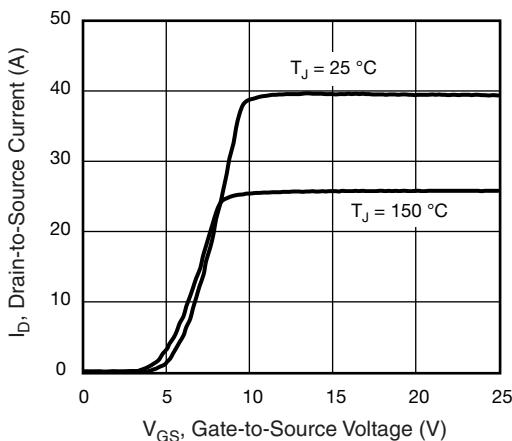
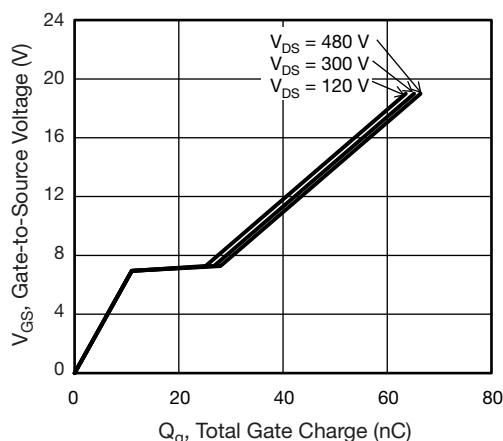
- Repetitive rating; pulse width limited by maximum junction temperature.
- $V_{DD} = 50$ V, starting $T_J = 25$ °C, $L = 11.6$ mH, $R_g = 25$ Ω, $I_{AS} = 4.2$ A.
- 1.6 mm from case.
- $I_{SD} \leq I_D$, $dI/dt = 100$ A/μs, starting $T_J = 25$ °C.

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	62	
Maximum Junction-to-Case (Drain)	R_{thJC}	-	0.7	°C/W

SPECIFICATIONS ($T_J = 25$ °C, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0$ V, $I_D = 250$ μA		600	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to 25 °C, $I_D = 1$ mA		-	0.71	-	V/°C
Gate-Source Threshold Voltage (N)	$V_{GS(th)}$	$V_{DS} = V_{GS}$, $I_D = 250$ μA		2	-	4	V
Gate-Source Leakage	I_{GSS}	$V_{GS} = \pm 20$ V		-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 600$ V, $V_{GS} = 0$ V		-	-	1	
		$V_{DS} = 480$ V, $V_{GS} = 0$ V, $T_J = 125$ °C		-	-	10	μA
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10$ V	$I_D = 8$ A	-	0.23	0.28	Ω
Forward Transconductance	g_{fs}	$V_{DS} = 30$ V, $I_D = 8$ A		-	4.6	-	S
Dynamic							
Input Capacitance	C_{iss}	$V_{GS} = 0$ V, $V_{DS} = 100$ V, $f = 1$ MHz		-	1350	-	pF
Output Capacitance	C_{oss}			-	70	-	
Reverse Transfer Capacitance	C_{rss}			-	5	-	
Effective Output Capacitance, Energy Related ^a	$C_{o(er)}$	$V_{DS} = 0$ V to 480 V, $V_{GS} = 0$ V		-	53	-	
Effective Output Capacitance, Time Related ^b	$C_{o(tr)}$			-	177	-	
Total Gate Charge	Q_g			-	39	78	nC
Gate-Source Charge	Q_{gs}	$V_{GS} = 10$ V	$I_D = 8$ A, $V_{DS} = 480$ V	-	11	-	
Gate-Drain Charge	Q_{gd}			-	17	-	
Turn-On Delay Time	$t_{d(on)}$			-	16	32	ns
Rise Time	t_r	$V_{DD} = 480$ V, $I_D = 8$ A, $V_{GS} = 10$ V, $R_g = 9.1$ Ω		-	26	52	
Turn-Off Delay Time	$t_{d(off)}$		-	41	82		
Fall Time	t_f		-	22	44		
Gate Input Resistance	R_g	$f = 1$ MHz, open drain		-	0.86	-	Ω
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode		-	-	15	A
Pulsed Diode Forward Current	I_{SM}			-	-	60	
Diode Forward Voltage	V_{SD}	$T_J = 25$ °C, $I_S = 8$ A, $V_{GS} = 0$ V		-	1.0	1.2	V
Reverse Recovery Time	t_{rr}	$T_J = 25$ °C, $I_F = I_S = 8$ A, $dI/dt = 100$ A/μs, $V_R = 25$ V		-	302	604	ns
Reverse Recovery Charge	Q_{rr}			-	4.0	8	μC
Reverse Recovery Current	I_{RRM}			-	24	-	A

Notes

a. $C_{oss(er)}$ is a fixed capacitance that gives the same energy as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DSS} .
b. $C_{oss(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DSS} .

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

Fig. 1 - Typical Output Characteristics

Fig. 4 - Normalized On-Resistance vs. Temperature

Fig. 2 - Typical Output Characteristics

Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

Fig. 3 - Typical Transfer Characteristics

Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

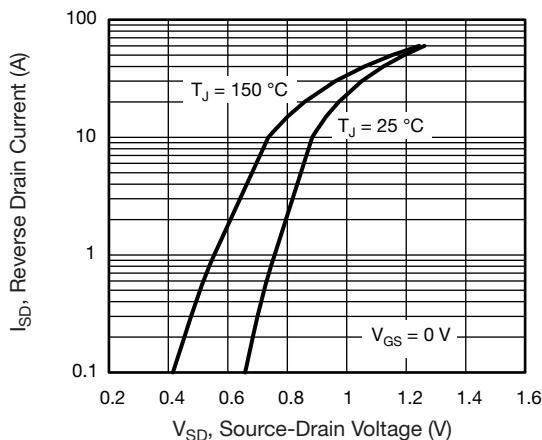


Fig. 7 - Typical Source-Drain Diode Forward Voltage

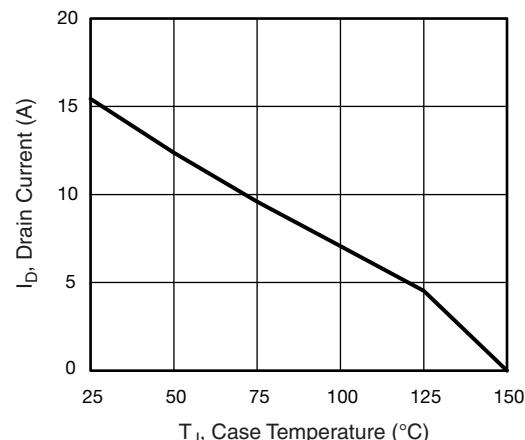


Fig. 9 - Maximum Drain Current vs. Case Temperature

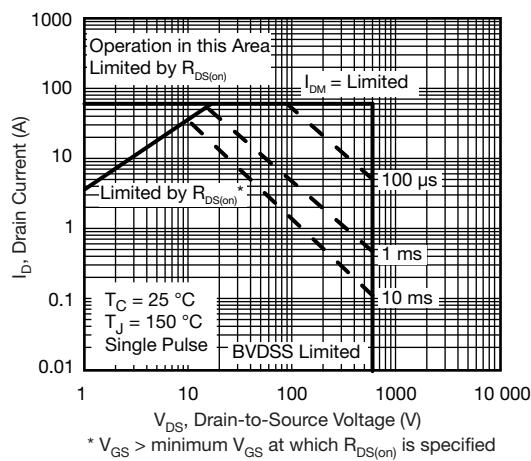


Fig. 8 - Maximum Safe Operating Area

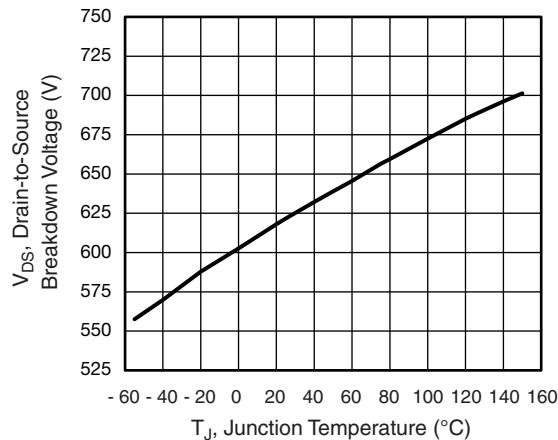


Fig. 10 - Temperature vs. Drain-to-Source Voltage

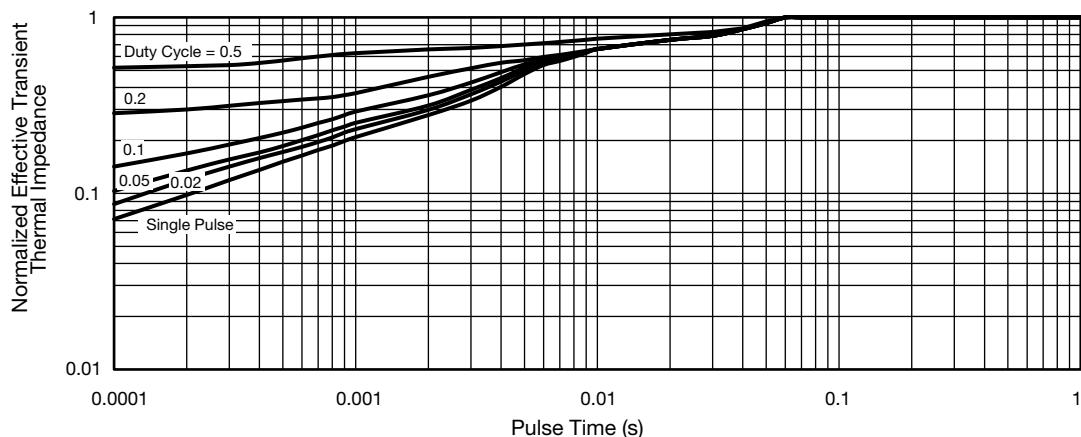


Fig. 11 - Normalized Thermal Transient Impedance, Junction-to-Case

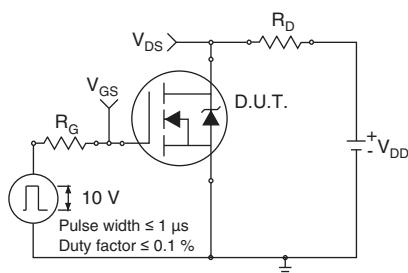


Fig. 12 - Switching Time Test Circuit

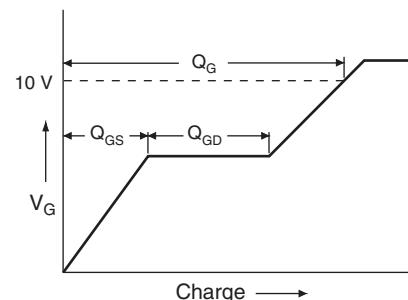


Fig. 16 - Basic Gate Charge Waveform

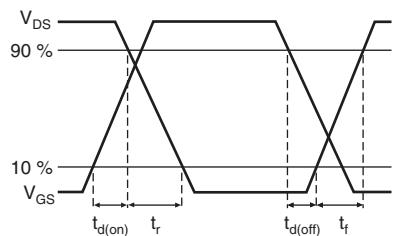


Fig. 13 - Switching Time Waveforms

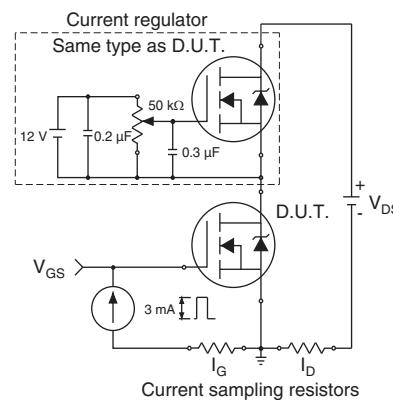


Fig. 17 - Gate Charge Test Circuit

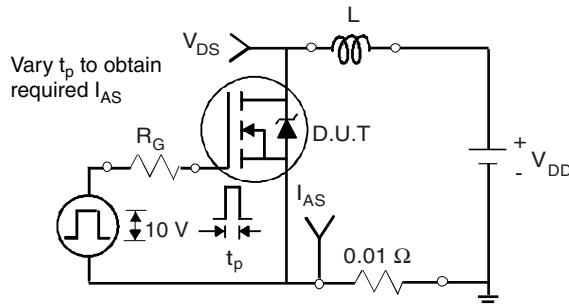


Fig. 14 - Unclamped Inductive Test Circuit

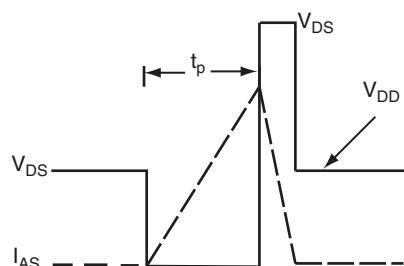
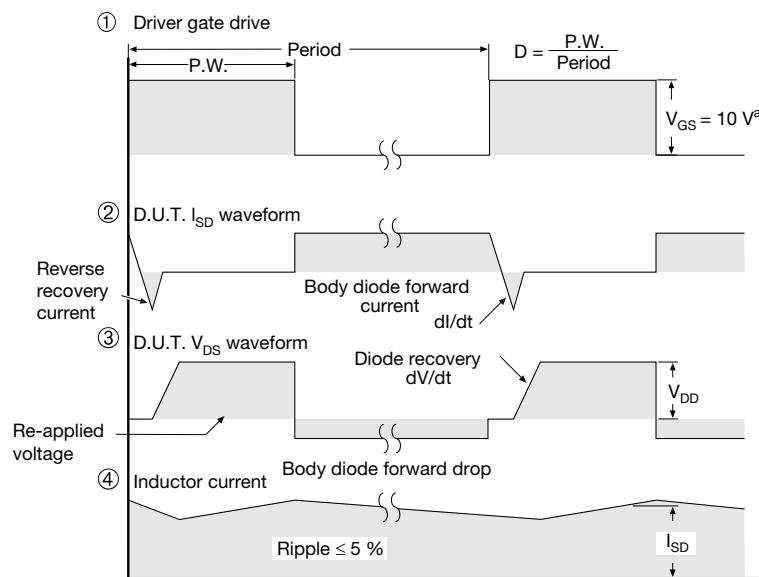
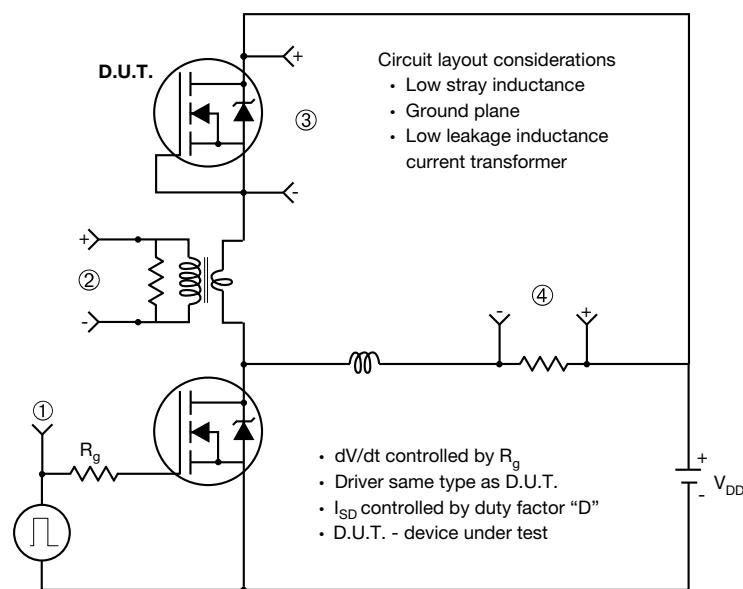


Fig. 15 - Unclamped Inductive Waveforms

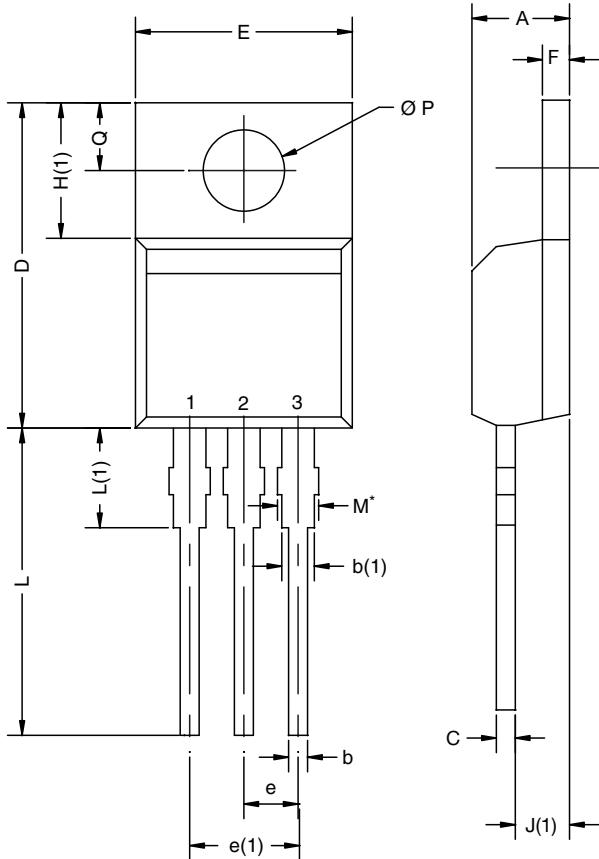
Peak Diode Recovery dV/dt Test Circuit

Note

a. $V_{GS} = 5 \text{ V}$ for logic level devices

Fig. 18 - For N-Channel

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TO-220AB



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.25	4.65	0.167	0.183
b	0.69	1.01	0.027	0.040
b(1)	1.20	1.73	0.047	0.068
c	0.36	0.61	0.014	0.024
D	14.85	15.49	0.585	0.610
E	10.04	10.51	0.395	0.414
e	2.41	2.67	0.095	0.105
e(1)	4.88	5.28	0.192	0.208
F	1.14	1.40	0.045	0.055
H(1)	6.09	6.48	0.240	0.255
J(1)	2.41	2.92	0.095	0.115
L	13.35	14.02	0.526	0.552
L(1)	3.32	3.82	0.131	0.150
Ø P	3.54	3.94	0.139	0.155
Q	2.60	3.00	0.102	0.118

Note

* M = 1.32 mm to 1.62 mm (dimension including protrusion)
Heatsink hole for HVM

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