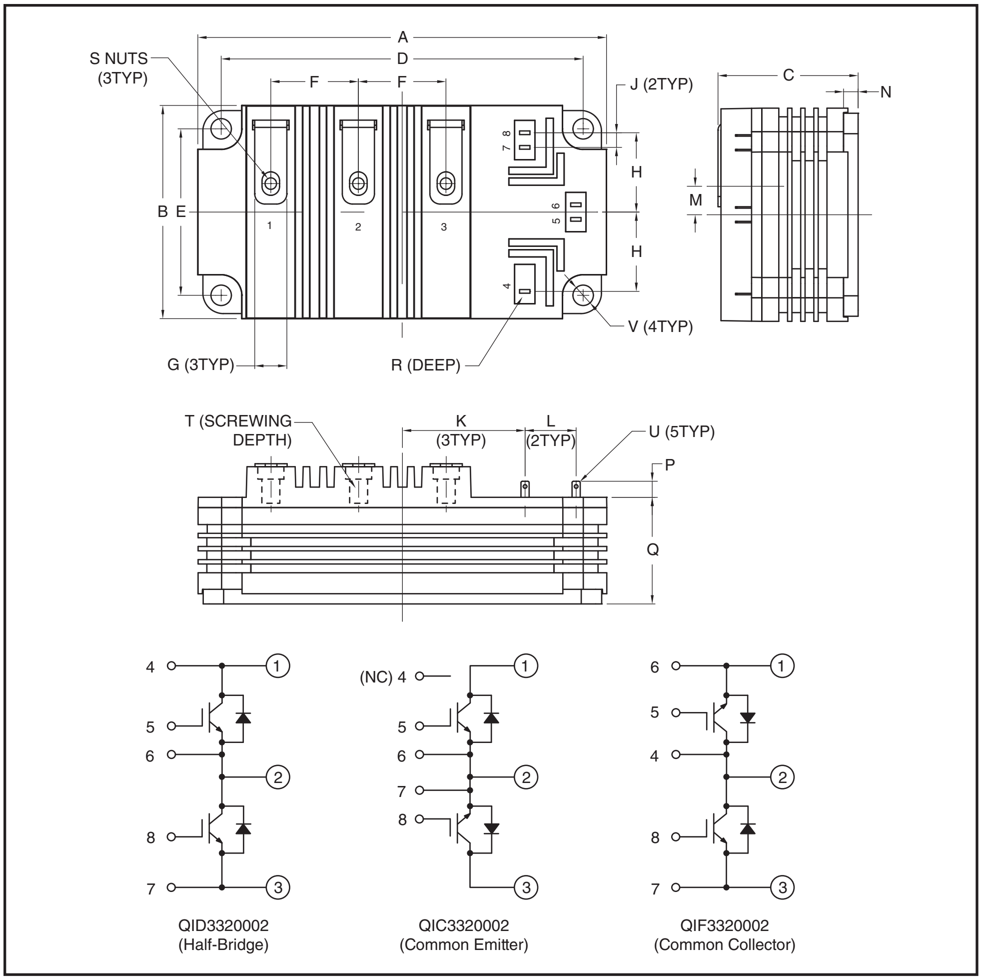
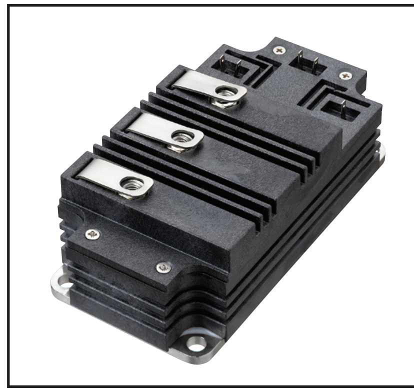
Powerex, Inc., 173 Pavilion Lane, Youngwood, Pennsylvania 15697 (724) 925-7272
www.pwrx.com

QI_3320002

Dual IGBT HVIGBT Module
200 Amperes/3300 Volts





Outline Drawing and Circuit Diagram

Dimensions	Inches	Millimeters
A	5.51	140.0
B	2.87	73.0
C	1.89	48.0
D	4.88±0.01	124.0±0.25
E	2.24±0.01	57.0±0.25
F	1.18	30.0
G	0.43	11.0
H	1.07	27.15
J	0.20	5.0
K	1.65	42.0

Dimensions	Inches	Millimeters
L	0.69±0.01	17.5±0.25
M	0.38	9.75
N	0.20	5.0
P	0.22	5.5
Q	1.44	36.5
R	0.16	4.0
S	M6 Metric	M6
T	0.63 Min.	16.0 Min.
U	0.11 x 0.02	2.8 x 0.5
V	0.28 Dia.	7.0 Dia.

Description:
Powerex HVIGBTs feature highly insulating housings that offer enhanced protection by means of greater creepage and strike clearance distance for many demanding applications like medium voltage drives and auxiliary traction applications.

Features:
- ☐ -40 to 150°C Temperature Range
- ☐ 100% Dynamic Tested
- ☐ 100% Partial Discharge Tested
- ☐ Advanced Mitsubishi R-Series Chip Technology
- ☐ Aluminum Nitride (AIN) Ceramic Substrate for Low Thermal Impedance
- ☐ Complementary Line-up in Expanding Current Ranges to Mitsubishi HVIGBT Power Modules
- ☐ Copper Baseplate
- ☐ Creepage and Clearance Meet IEC 60077-1
- ☐ Rugged SWSOA and RRSOA

Applications:
- ☐ High Voltage Power Supplies
- ☐ Medium Voltage Drives
- ☐ Motor Drives
- ☐ Traction

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Absolute Maximum Ratings, T_j = 25 °C unless otherwise specified

Ratings	Symbol	QI_3320002	Units
Junction Temperature	T_j	-40 to 150	°C
Storage Temperature	T_{stg}	-40 to 125	°C
Operating Temperature	T_{jop}	-40 to 125	°C
Collector-Emitter Voltage (V_{GE} = 0V)	V_{CES}	3300	Volts
Gate-Emitter Voltage (V_{CE} = 0V)	V_{GES}	±20	Volts
Collector Current (T_C = 102°C)	I_C	200	Amperes
Collector Current (T_C = 25°C)	I_C	370	Amperes
Peak Collector Current (Pulse)	I_{CM}	400*1	Amperes
Diode Forward Current (T_C = 99°C)*2	I_F	200	Amperes
Diode Forward Surge Current (Pulse)*2	I_{FM}	400*1	Amperes
I^2t for Diode (t = 10ms, V_R = 0V, T_j = 125°C)	I^2t	15	kA^2sec
Maximum Collector Dissipation (T_C = 25°C, IGBT Part, $T_{j(max)} \leq$ 150°C)	P_C	1780	Watts
Mounting Torque, M6 Terminal Screws	—	44	in-lb
Mounting Torque, M6 Mounting Screws	—	44	in-lb
Module Weight (Typical)	—	900	Grams
Isolation Voltage (Charged Part to Baseplate, AC 60Hz 1 min.)	V_{iso}	10.2	kVolts
Partial Discharge (V1 = 4800 V_{RMS}, V2 = 3500 V_{RMS}, f = 60Hz (Acc. to IEC 1287))	Q_{pd}	10	pC
Maximum Short-Circuit Pulse Width, ($V_{CC} \leq$ 2500V, $V_{CE} \leq V_{CES}$, V_{GE} = +15V/-8V, $R_{G(on)}$ = 15Ω, $R_{G(off)}$ = 50Ω, T_j = 125°C)	t_{psc}	10	µs

Electrical Characteristics, T_j = 25 °C unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Collector-Cutoff Current	I_{CES}	$V_{CE} = V_{CES}$, V_{GE} = 0V	—	—	2.0	mA
Gate Leakage Current	I_{GES}	$V_{GE} = V_{GES}$, V_{CE} = 0V	—	—	0.5	µA
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	I_C = 15mA, V_{CE} = 10V	5.5	6.0	6.5	Volts
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C = 200A, V_{GE} = 15V, T_j = 25°C	—	2.7*3	3.3	Volts
		I_C = 200A, V_{GE} = 15V, T_j = 125°C	—	3.4	4.0	Volts
		I_C = 200A, V_{GE} = 15V, T_j = 150°C	—	3.6	—	Volts
Total Gate Charge	Q_G	V_{CC} = 1800V, I_C = 170A, V_{GE} = 15V	—	1.8	—	µC
Emitter-Collector Voltage*2	V_{EC}	I_E = 200A, V_{GE} = 0V, T_j = 25°C	—	2.3	3.0	Volts
		I_E = 200A, V_{GE} = 0V, T_j = 125°C	—	2.45	—	Volts
		I_E = 200A, V_{GE} = 0V, T_j = 150°C	—	2.55	—	Volts

*1 Pulse width and repetition rate should be such that device junction temperature (T_j) does not exceed $T_{j(max)}$ rating.
*2 Represents characteristics of the anti-parallel, emitter-to-collector free-wheel diode (FWDi).
*3 Pulse width and repetition rate should be such that device junction temperature rise is negligible.

Electrical Characteristics, T_j = 25 °C unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Input Capacitance	C_{ies}	V_{GE} = 0V, V_{CE} = 10V	—	23	—	nF
Output Capacitance	C_{oes}		—	1.5	—	nF
Reverse Transfer Capacitance	C_{res}		—	0.7	—	nF
Turn-on Delay Time	$t_{d(on)}$	V_{CC} = 1650V, I_C = 200A,	—	800	1100	ns
Rise Time	t_r	V_{GE} = +15V/-8V,	—	160	250	ns
Turn-off Delay Time	$t_{d(off)}$	$R_{G(on)}$ = 15Ω, $R_{G(off)}$ = 50Ω,	—	3200	3400	ns
Fall Time	t_f	L_S = 125nH, Inductive Load	—	1300	1500	ns
Turn-on Switching Energy	E_{on}	T_j = 125°C, I_C = 200A, V_{GE} = +15V/-8V,	—	335	—	mJ/P
Turn-off Switching Energy	E_{off}	$R_{G(on)}$ = 15Ω, $R_{G(off)}$ = 50Ω, V_{CC} = 1650V, L_S = 125nH, Inductive Load	—	275	—	mJ/P
Diode Reverse Recovery Time*2	t_{rr}	V_{CC} = 1650V, I_E = 200A,	—	500	—	ns
Diode Reverse Recovery Charge*2	Q_{rr}	V_{GE} = +15V/-8V, $R_{G(on)}$ = 15Ω,	—	180*3	—	μC
Diode Reverse Recovery Energy	E_{rec}	L_S = 125nH, Inductive Load, T_j = 125°C	—	190	—	mJ/P
Stray Inductance (C1-E2)	L_{SCE}		—	60	—	nH
Lead Resistance Terminal-Chip	R_{CE}		—	0.8	—	mΩ

Thermal and Mechanical Characteristics, T_j = 25 °C unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Thermal Resistance, Junction to Case*4	$R_{th(j-c)}$ Q	Per IGBT	—	—	0.074	°C/W
Thermal Resistance, Junction to Case*4	$R_{th(j-c)}$ D	Per FWDi	—	—	0.11	°C/W
Contact Thermal Resistance, Case to Fin	$R_{th(c-f)}$	Per Module, Thermal Grease Applied, λ_{grease} = 1W/mK	—	0.018	—	°C/W
Clearance Distance in Air (Terminal to Base)	$d_{a(t-b)}$		35.0	—	—	mm
Creepage Distance Along Surface (Terminal to Base)	$d_{s(t-b)}$		64	—	—	mm
Clearance Distance in Air (Terminal to Terminal)	$d_{a(t-t)}$		19	—	—	mm
Creepage Distance Along Surface (Terminal to Terminal)	$d_{s(t-t)}$		54	—	—	mm

*2 Represents characteristics of the anti-parallel, emitter-to-collector free-wheel diode (FWDi).
*3 Pulse width and repetition rate should be such that device junction temperature rise is negligible.
*4 T_C measurement point is just under the chips.

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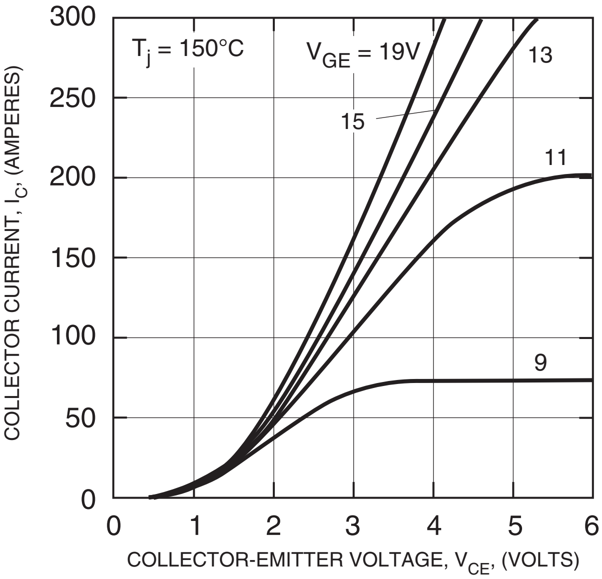
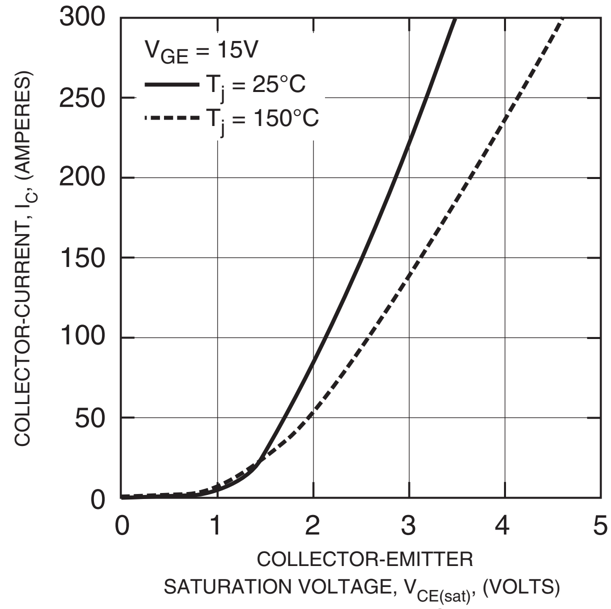
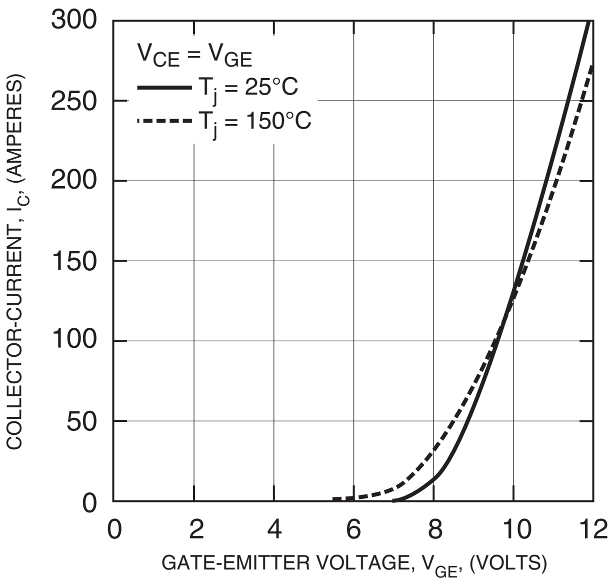
OUTPUT CHARACTERISTICS (TYPICAL)



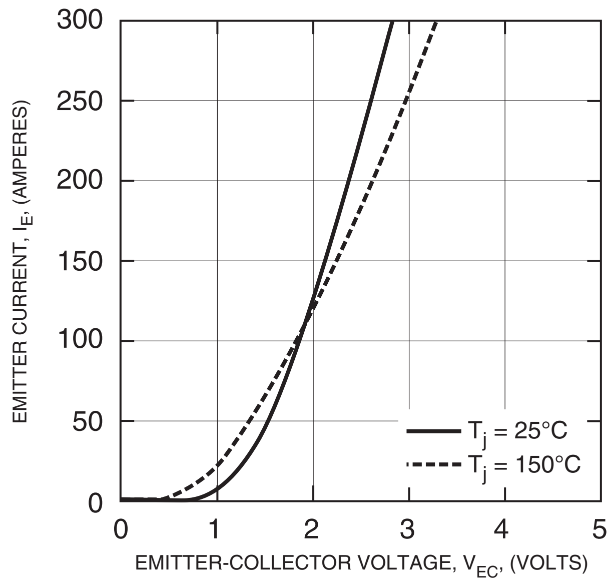
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



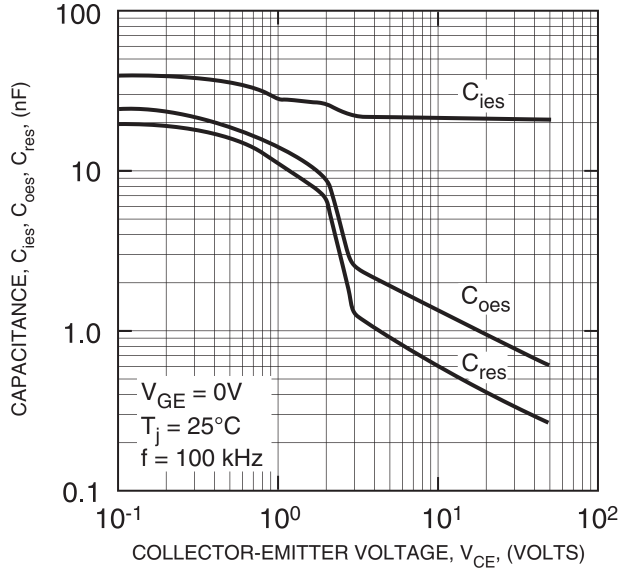
TRANSFER CHARACTERISTICS (TYPICAL)



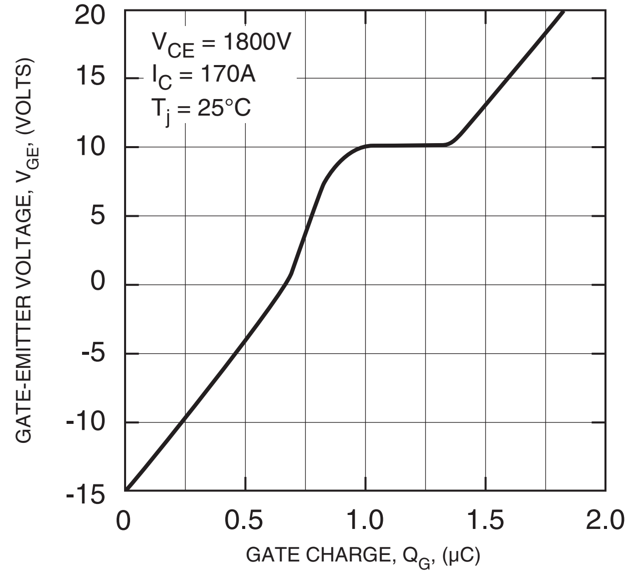
FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)



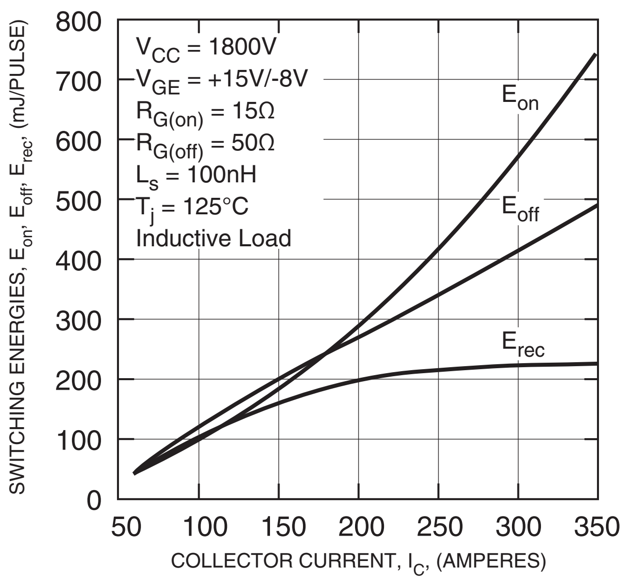
CAPACITANCE VS. V_{CE} (TYPICAL)



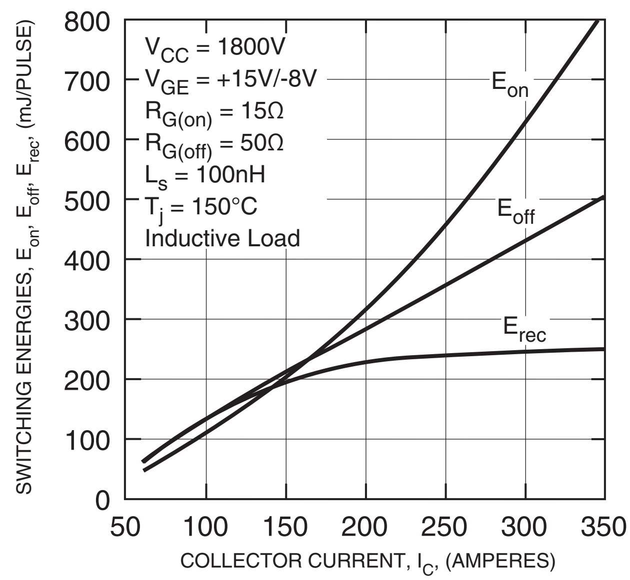
GATE CHARGE VS. V_{GE}



SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



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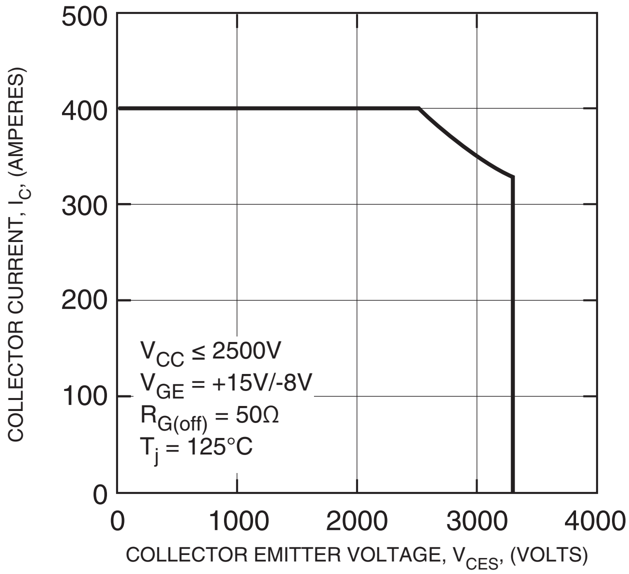
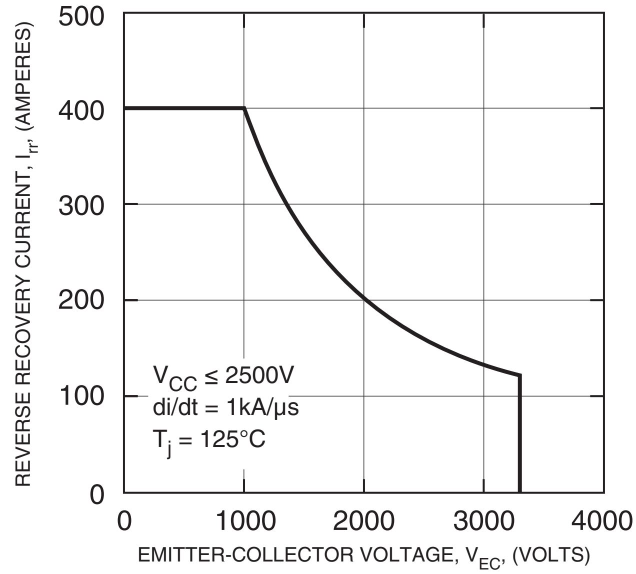
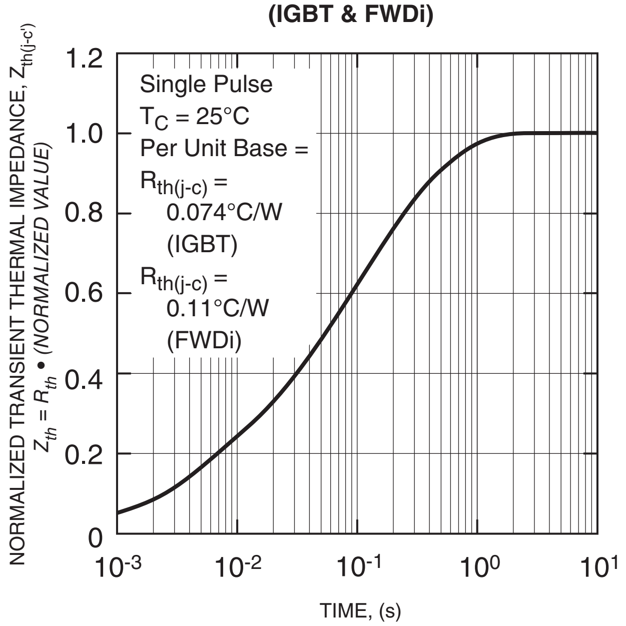
REVERSE BIAS SAFE OPERATING AREA (TYPICAL)



FREE-WHEEL DIODE REVERSE RECOVERY SAFE OPERATING AREA (TYPICAL)



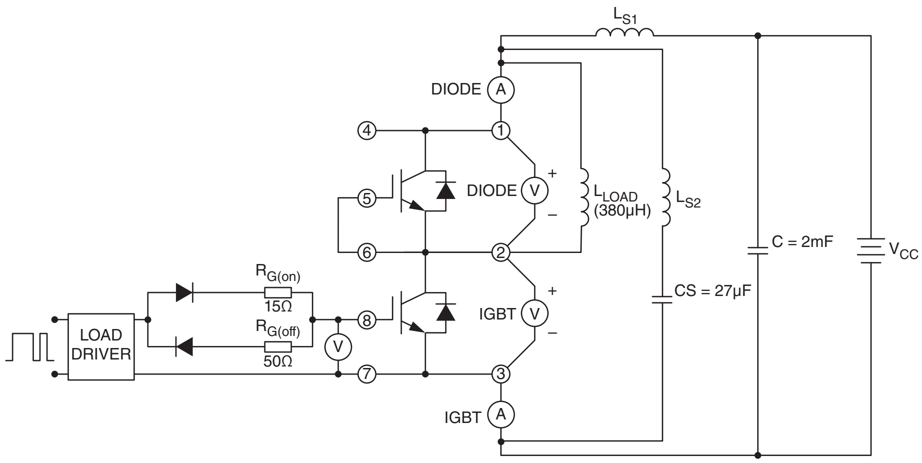
TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (IGBT & FWDi)



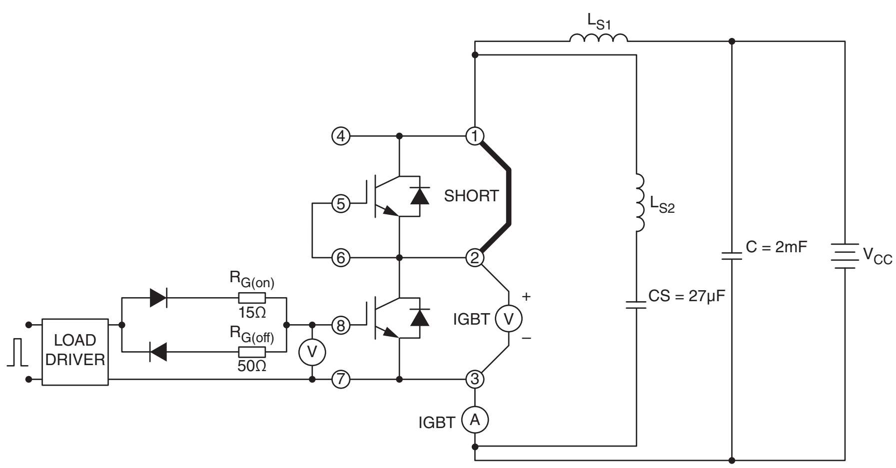
$$Z_{th(j\text{-}c)}(t) = \sum_{i=1}^{n} R_i \left\{ 1 - exp^{\left(\frac{-t}{\tau_i}\right)} \right\}$$

	1	2	3	4
R_i [K/kW] :	-0.0017	0.0059	0.0131	0.0555
t_i [sec] :	0.0003	0.0011	0.0048	0.0732

Turn-on, Turn-off and Reverse Recovery Test Circuit for QID3320002



Short Circuit Test Circuit for QID3320002



Notes:

1. Total stray inductance L_S = 125nH.
2. Short circuit test is done with a copper bar between upper IGBT collector and emitter.
3. Test temperature is controlled with a heating plate set for +125°C.