TGH40N65F2DR
Field Stop Trench IGBT

Features
- 650V Field Stop Trench IGBT Technology
- Low Conduction Loss
- Positive Temperature Coefficient
- Easy Parallel Operation
- 175℃ Operating Temperature
- Short Circuit Withstanding Time 5μs
- RoHS Compliant
- JEDEC Qualification

TO-247

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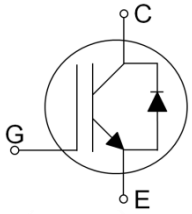

Applications
UPS, Welder, Inverter, Solar

Device	Package	Marking	Remark
TGH40N65F2DR	TO-247	TGH40N65F2DR	RoHS

Absolute Maximum Ratings

Parameter		Symbol	Value	Unit
Collector-Emitter Voltage		V_{CES}	650	V
Gate-Emitter Voltage		V_{GES}	±20	V
Continuous Collector Current	T_C = 25 ℃	I_C	80	A
	T_C = 100 ℃		40	A
Pulsed Collector Current (Note 1)		I_{CM}	120	A
Diode Continuous Forward Current	T_C = 100 ℃	I_F	40	A
Diode Pulsed Current (Note 2)		I_{FM}	200	A
Power Dissipation	T_C = 25 ℃	P_D	283	W
	T_C = 100 ℃		142	W
Operating Junction Temperature		T_{vj}	-55 ~ 175	℃
Storage Temperature Range		T_{STG}	-55 ~ 150	℃
Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds		T_L	300	℃

Notes :
(1) Repetitive rating : Pulse width limited by maximum junction temperature, During production, high current switching capability is 100% verified with the inductive load single-pulse switching test. (Ic=120A)
(2) Repetitive rating : Pulse width limited by maximum junction temperature.

Thermal Characteristics

Parameter	Symbol	Value	Unit
Maximum Thermal resistance, Junction-to-Case	$R_{\theta JC}$ (IGBT)	0.53	℃/W
Maximum Thermal resistance, Junction-to-Case	$R_{\theta JC}$ (DIODE)	1.43	℃/W
Maximum Thermal resistance, Junction-to-Ambient	$R_{\theta JA}$	40	℃/W

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Electrical Characteristics of the IGBT T_{vj}=25℃, unless otherwise noted

Parameter	Symbol	Test condition	Min.	Typ.	Max.	Unit
OFF						
Collector – Emitter Breakdown Voltage	BV_{CES}	V_{GE} = 0V, I_C = 1mA	650	--	--	V
Zero Gate Voltage Collector Current	I_{CES}	V_{CE} = 650V, V_{GE} = 0V	--	--	1	mA
Gate – Emitter Leakage Current	I_{GES}	V_{CE} = 0V, V_{GE} = ± 20V	--	--	± 250	nA
Integrated Gate Resistance	$R_{G(int)}$	f = 1MHz, Open Collector	--	3.9	--	Ω
ON						
Gate – Emitter Threshold Voltage	$V_{GE(TH)}$	V_{GE} = V_{CE}, I_C = 40mA	4.5	6.0	7.5	V
Collector – Emitter Saturation Voltage	$V_{CE(SAT)}$	V_{GE} = 15V, I_C = 40A, T_{vj} = 25 ℃	--	1.60	2.10	V
		V_{GE} = 15V, I_C = 40A, T_{vj} = 125 ℃	--	1.81	--	V
		V_{GE} = 15V, I_C = 40A, T_{vj} = 175 ℃	--	1.94	--	V
DYNAMIC						
Input Capacitance	C_{IES}	V_{CE} = 30V V_{GE} = 0V f = 1MHz	--	2274	--	pF
Output Capacitance	C_{OES}		--	114	--	pF
Reverse Transfer Capacitance	C_{RES}		--	72	--	pF
Total Gate Charge	Q_g	V_{CC} = 400V, I_C = 40A V_{GE} = 15V	--	121	182	nC
Gate-Emitter Charge	Q_{ge}		--	15	22	nC
Gate-Collector Charge	Q_{gc}		--	59	89	nC
SWITCHING (Note 3)						
Turn-On Delay Time	$t_{d(on)}$	V_{CC} = 400V, I_C = 20A R_G = 5Ω, V_{GE} = 15V Inductive Load, T_{vj} = 25 ℃	--	25	--	ns
Rise Time	t_r		--	18	--	ns
Turn-Off Delay Time	$t_{d(off)}$		--	126	--	ns
Fall Time	t_f		--	34	--	ns
Turn-On Switching Loss	E_{ON}		--	0.36	--	mJ
Turn-Off Switching Loss	E_{OFF}		--	0.26	--	mJ
Total Switching Loss	E_{TS}		--	0.62	--	mJ
Turn-On Delay Time	$t_{d(on)}$	V_{CC} = 400V, I_C = 40A R_G = 5Ω, V_{GE} = 15V Inductive Load, T_{vj} = 25 ℃	--	28	--	ns
Rise Time	t_r		--	29	--	ns
Turn-Off Delay Time	$t_{d(off)}$		--	108	--	ns
Fall Time	t_f		--	37	--	ns
Turn-On Switching Loss	E_{ON}		--	1.06	1.59	mJ
Turn-Off Switching Loss	E_{OFF}		--	0.55	0.83	mJ
Total Switching Loss	E_{TS}		--	1.61	2.42	mJ

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Electrical Characteristics of the IGBT T_{vj}=25℃, unless otherwise noted

Parameter	Symbol	Test condition	Min.	Typ.	Max.	Unit
SWITCHING (Note 3)						
Turn-On Delay Time	$t_{d(on)}$	V_{CC} = 400V, I_C = 20A R_G = 5Ω, V_{GE} = 15V Inductive Load, T_{vj} = 175 ℃	--	23	--	ns
Rise Time	t_r		--	16	--	ns
Turn-Off Delay Time	$t_{d(off)}$		--	166	--	ns
Fall Time	t_f		--	115	--	ns
Turn-On Switching Loss	E_{ON}		--	0.74	--	mJ
Turn-Off Switching Loss	E_{OFF}		--	0.59	--	mJ
Total Switching Loss	E_{TS}		--	1.33	--	mJ
Turn-On Delay Time	$t_{d(on)}$	V_{CC} = 400V, I_C = 40A R_G = 5Ω, V_{GE} = 15V Inductive Load, T_{vj} = 175 ℃	--	27	--	ns
Rise Time	t_r		--	32	--	ns
Turn-Off Delay Time	$t_{d(off)}$		--	137	--	ns
Fall Time	t_f		--	101	--	ns
Turn-On Switching Loss	E_{ON}		--	1.66	2.48	mJ
Turn-Off Switching Loss	E_{OFF}		--	1.01	1.52	mJ
Total Switching Loss	E_{TS}		--	2.67	4.00	mJ
Short Circuit Withstanding Time	t_{SC}	V_{CC} = 300V, V_{GE} = 15V, T_{vj} = 125℃	5	--	--	μs

Notes :
(3) Not subject to production test – verified by design/characterization

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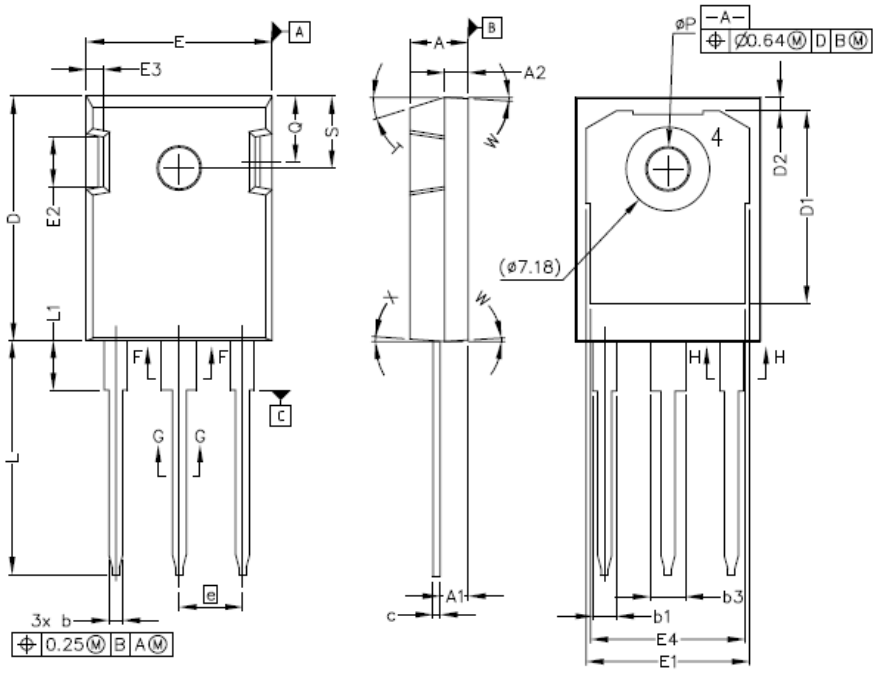
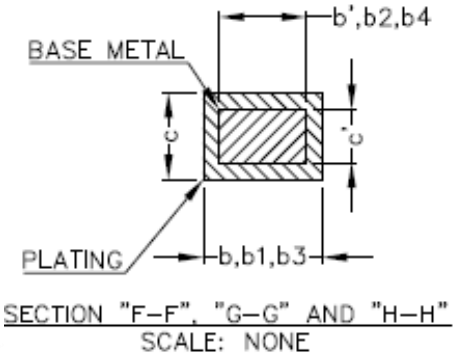
Electrical Characteristics of the DIODE T_{vj}=25℃, unless otherwise noted

Parameter	Symbol	Test condition	Min.	Typ.	Max.	Unit
Diode Forward Voltage	V_{FM}	I_F = 20A, T_{vj} = 25 ℃	--	1.70	--	V
		I_F = 20A, T_{vj} = 125 ℃	--	1.54	--	V
		I_F = 20A, T_{vj} = 175 ℃	--	1.41	--	V
		I_F = 40A, T_{vj} = 25 ℃	--	2.10	--	V
		I_F = 40A, T_{vj} = 125 ℃	--	2.03	--	V
		I_F = 40A, T_{vj} = 175 ℃	--	1.94	--	V
Reverse Recovery Time	t_{rr}	I_F = 20A, di/dt = 200A/μs, T_{vj} = 25 ℃	--	99	--	ns
Reverse Recovery Current	I_{rr}		--	5.6	--	A
Reverse Recovery Charge	Q_{rr}		--	256	--	nC
Reverse Recovery Time	t_{rr}	I_F = 20A, di/dt = 200A/μs, T_{vj} = 175 ℃	--	163	--	ns
Reverse Recovery Current	I_{rr}		--	12.6	--	A
Reverse Recovery Charge	Q_{rr}		--	1266	--	nC
Reverse Recovery Time	t_{rr}	I_F = 40A, di/dt = 200A/μs, T_{vj} = 25 ℃	--	113	--	ns
Reverse Recovery Current	I_{rr}		--	5.9	--	A
Reverse Recovery Charge	Q_{rr}		--	322	--	nC
Reverse Recovery Time	t_{rr}	I_F = 40A, di/dt = 200A/μs, T_{vj} = 175 ℃	--	201	--	ns
Reverse Recovery Current	I_{rr}		--	13.3	--	A
Reverse Recovery Charge	Q_{rr}		--	1660	--	nC

Preliminary datasheet

TO-247 MECHANICAL DATA





SYM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.83	5.21	.190	.205
A1	2.29	2.54	.090	.100
A2	1.91	2.16	.075	.085
b'	1.07	1.28	.042	.050
b	1.07	1.33	.042	.052
b1	1.91	2.41	.075	.095
b2	1.91	2.16	.075	.085
b3	2.87	3.38	.113	.133
b4	2.87	3.13	.113	.123
c'	0.55	0.65	.022	.026
c	0.55	0.68	.022	.027
D	20.80	21.10	.819	.831
D1	16.25	17.65	.640	.695
D2	0.95	1.25	.037	.049
E	15.75	16.13	.620	.635
E1	13.10	14.15	.516	.557
E2	3.68	5.10	.145	.201
E3	1.00	1.90	.039	.075
E4	12.38	13.43	.487	.529
e	5.44 BSC		.214 BSC	
N	3		3	
L	19.81	20.32	.780	.800
L1	4.10	4.40	.161	.173
øP	3.51	3.65	.138	.144
Q	5.49	6.00	.216	.236
S	6.04	6.30	.238	.248
T	17.5° REF.			
W	3.5° REF.			
X	4° REF.			

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